

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

## INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART E REQUIREMENT

OF

**Product Name:** HP Slate 8 Pro

**Brand Name:** hp

**Model No.:** 7650xx

**Model Difference:** xx means other numerical or alphabetic characters for different regions.

**FCC ID:** B94HHC13CN

**Report No.:** ER/2014/30016

**Issue Date:** Mar. 25, 2014

**FCC Rule Part:** §15.407

**Prepared for:** Hewlett-Packard Company  
3000, Hanover Street Palo Alto, CA 94304  
USA

**Prepared by:** SGS Taiwan Ltd.  
Electronics & Communication Laboratory  
No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803



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## VERIFICATION OF COMPLIANCE

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 3000, Hanover Street, Palo Alto, CA 94304, USA

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**Brand Name:** hp

**Model No.:** 7650xx

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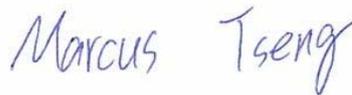
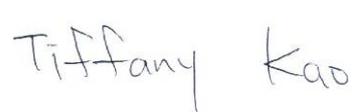
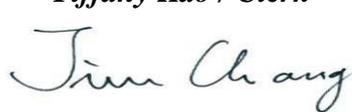
**Date of test:** Aug. 30, 2013 ~ Sep. 10, 2013

**Date of EUT Received:** Aug. 30, 2013

**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in FCC 06-96 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.407.

The test results of this report relate only to the tested sample identified in this report.

<b>Test By:</b>	 <hr style="border: 0.5px solid black;"/> Marcus Tseng / Engineer	<b>Date:</b>	Mar. 25, 2014
<b>Prepared By:</b>	 <hr style="border: 0.5px solid black;"/> Tiffany Kao / Clerk	<b>Date:</b>	Mar. 25, 2014
<b>Approved By:</b>	 <hr style="border: 0.5px solid black;"/> Jim Chang / Supervisor	<b>Date:</b>	Mar. 25, 2014

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## Version

Version No.	Date	Description
00	Mar. 25, 2014	Initial creation of document

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# 1. GENERAL INFORMATION

## 1.1. Product Description

General:

Product Name:	HP Slate 8 Pro	
Brand Name:	hp	
Model No.:	7650xx	
Model Difference:	xx means other numerical or alphabetic characters for different regions.	
Data Cable (USB):	Model No.: N/A, Supplier: Various	
Hardware Version:	PV (3.4.66-g11700e4)	
Software Version:	Android 4.4.2	
Power Supply:	3.7Vdc from Li-ion battery or 5.3Vdc from AC/DC adapter	
	Battery:	Model No.: HSTNH-C13C-S, Supplier: Samsung SDI
	Adapter:	Model No.: 8395-V001-1080, Supplier: FOXLINK

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WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Rated Power (Avg.)	Modulation Technology
11a	5150~5250	4	13.20dBm (Avg.)	OFDM
	5250~5350	4	13.20dBm (Avg.)	
	5470~5725	11	13.20 dBm (Avg.)	
11n	HT20 5150~5250	4	Avg. Power: HT 20: 13.23dBm (MIMO Chain 0):10.57dBm (MIMO Chain 1): 9.88dBm (MIMO Chain 0+1): 13.23dBm	OFDM
	HT20 5250~5350	4	Avg. Power: HT 20: 13.24dBm (MIMO Chain 0): 10.77dBm (MIMO Chain 1): 9.92dBm (MIMO Chain 0+1): 13.33dBm	
	HT20 5470~5725	8	Avg. Power: HT 20: 13.11dBm (MIMO Chain 0): 10.83dBm (MIMO Chain 1): 9.92dBm (MIMO Chain 0+1): 13.24dBm	

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11n	HT40 5150-5250	2	Avg. Power: HT 40: 11.42dBm (MIMO Chain 0): 11.00dBm (MIMO Chain 1): 10.55dBm (MIMO Chain 0+1): 13.79dBm	OFDM
	HT40 5250-5350	2	Avg. Power: HT40: 11.38dBm (MIMO Chain 0): 11.31dBm (MIMO Chain 1): 10.61dBm (MIMO Chain 0+1): 13.98dBm	
	HT40 5470-5725	3	Avg. Power: HT40: 11.42dBm (MIMO Chain 0):11.31dBm (MIMO Chain 1): 10.68dBm (MIMO Chain 0+1): 13.96dBm	
Antenna Designation			PIFA Antenna 1. Main: Part NO.: HP4589-12-000-C (DC33001FV30) 5GHz Gain: 0.56dBi (5150MHz-5250MHz) 5GHz Gain: 0.56dBi (5250MHz-5350MHz) 5GHz Gain: 0.56dBi (5470MHz-5725MHz)  2. Aux: Part NO.: HP4590-12-000-C (DC33001FV40) 5GHz Gain: -0.35dBi (5150MHz-5250MHz) 5GHz Gain: -0.35dBi (5250MHz-5350MHz) 5GHz Gain: 0.27dBi (5470MHz-5725MHz)	
Modulation type			CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM	
Transition Rate:			802.11 a: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 144Mbps 802.11 n_40MHz: 13.5 – 300Mbps	

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IEEE 802.11n Spec:

MCS Index	Nss	Modulation	R	NBPS	NCBPS		NDBPS		Datarate(Mbps)			
					20MHz	40MHz	20MHz	40MHz	800nsGI		400nsGI	
									20MHz	40MHz	20MHz	40MHz
0	1	BPSK	1/2	1	52	108	26	54	6.5	13.5	7.200	15
1	1	QPSK	1/2	2	104	216	52	108	13.0	27.0	14.400	30
2	1	QPSK	3/4	2	104	216	78	162	19.5	40.5	21.700	45
3	1	16-QAM	1/2	4	208	432	104	216	26.0	54.0	28.900	60
4	1	16-QAM	3/4	4	208	432	156	324	39.0	81.0	43.300	90
5	1	64-QAM	2/3	6	312	648	208	432	52.0	108.0	57.800	120
6	1	64-QAM	3/4	6	312	648	234	486	58.5	121.5	65.000	135
7	1	64-QAM	5/6	6	312	648	260	540	65.0	135.0	72.200	150

Symbol	Explanation
NSS	Number of spatial streams
R	Code rate
NBPS	Number of coded bite per single carrier
NCBPS	Number of coded bite per symbol
NDBPS	Number of data bite per symbol
GI	Guard interval

802.11n\_HT20 MCS8 -15

MCS Index	Modulation	R	NBPS <i>(i<sub>SS</sub>)</i>	N <sub>SD</sub>	N <sub>SP</sub>	N <sub>CBPS</sub>	N <sub>DBPS</sub>	Data rate (Mb/s)	
								800 ns GI	400 ns GI (see NOTE)
8	BPSK	1/2	1	52	4	104	52	13.0	14.4
9	QPSK	1/2	2	52	4	208	104	26.0	28.9
10	QPSK	3/4	2	52	4	208	156	39.0	43.3
11	16-QAM	1/2	4	52	4	416	208	52.0	57.8
12	16-QAM	3/4	4	52	4	416	312	78.0	86.7
13	64-QAM	2/3	6	52	4	624	416	104.0	115.6
14	64-QAM	3/4	6	52	4	624	468	117.0	130.0
15	64-QAM	5/6	6	52	4	624	520	130.0	144.4

NOTE—The 400 ns GI rate values are rounded to 1 decimal place.

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MCS Index	Modulation	R	$N_{BPSCS}(i_{SS})$	$N_{SD}$	$N_{SP}$	$N_{CBPS}$	$N_{DBPS}$	Data rate (Mb/s)	
								800 ns GI	400 ns GI
8	BPSK	1/2	1	108	6	216	108	27.0	30.0
9	QPSK	1/2	2	108	6	432	216	54.0	60.0
10	QPSK	3/4	2	108	6	432	324	81.0	90.0
11	16-QAM	1/2	4	108	6	864	432	108.0	120.0
12	16-QAM	3/4	4	108	6	864	648	162.0	180.0
13	64-QAM	2/3	6	108	6	1296	864	216.0	240.0
14	64-QAM	3/4	6	108	6	1296	972	243.0	270.0
15	64-QAM	5/6	6	108	6	1296	1080	270.0	300.0

This report applies for client device in order to be compliant DFS regulation.

*Note: The pertinent information with regards to the parameters of the detected Radar Waveforms is not available and accessible to the end user.*

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**2. SUMMARY OF TEST RESULT**

FCC Rules	Description Of Test	Result
§15.407(h)	TPC and DFS Measurement	Compliant

**3. MEASUREMENT UNCERTAINTY**

Test Items	Uncertainty
TPC and DFS Measurement	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC= +/- 0.2%

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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## 4. TPC and DFS MEASUREMENT

### 4.1. TPC: Standard Applicable

According to §15.407(h)(1), 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.

**4.1.1. Result:** N/A, The output power is less than 500mW.

### 4.2. DFS: Standard Applicable

According to §15.407(h)(2), Radar Detection Function of Dynamic Frequency Selection (DFS).

U-NII devices operating in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection.

(a) Devices shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems (see Note below). The minimum DFS radar signal detection threshold is -62 dBm for devices with a maximum e.i.r.p. less than 200 mW, and -64 dBm for devices with a maximum e.i.r.p. of 200 mW to 1 W. The detection threshold power is the received power, averaged over a 1-microsecond reference to a 0 dBi antenna. The DFS process shall provide a uniform spreading of the loading over all the available channels.

Note: Test procedures for demonstrating compliance with the DFS radar detection requirements set out in this section are being evaluated by Industry Canada. As an interim measure, the Department will, until further notice, accept utilization of the DFS test procedures published by the U.S. Federal Communications Commission (FCC)3 to demonstrate compliance with the requirements of this section.

(b) Operational requirements: the requirement for channel availability check time applies in the master operational mode. The requirement for channel move time applies in both the master and slave operational modes.

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- (i) In-service monitoring: an LE-LAN device should be able to monitor the operating channel to check that a co-channel radar has not moved or started operation within range of the LE-LAN device. During in-service monitoring, the LE-LAN radar detection function continuously searches for radar signals between normal LE-LAN transmissions.
- (ii) Channel availability check time: the device shall check if there is a radar system already operating on the channel before it initiates a transmission on a channel and when it moves to a channel. The device may start using the channel if no radar signal with a power level greater than the interference threshold value specified in A9.3 (a) above is detected within 60 seconds.
- (iii) Channel move time: after a radar's signal is detected, the device shall cease all transmissions on the operating channel within 10 seconds. Transmission during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. Intermittent management and control signals may also be sent during the remaining time to facilitate vacating the operating channel.
- (iv) Channel closing time: the maximum channel closing time is 260 ms. (v) Non-occupancy period: a channel that has been flagged as containing a radar signal, either by a channel availability check or in-service monitoring, is subject to a 30-minute non-occupancy period where the channel cannot be used by the LE-LAN device. The non-occupancy period starts from the time that the radar signal is detected.

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4.2.1. Limit

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	Yes	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required

Table 2: Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	Client(without radar detection)	Client(with radar detection)
Channel Closing Transmission time	Yes	Yes	Yes
Channel Move time	Yes	Yes	Yes

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**Table 3: 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 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.	

**Table 4: DFS Response requirement values**

Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	Minimum 80% of the 99% power bandwidth See Note 3.
Note 1: The instant that the <i>Channel Move Time</i> and the <i>Channel Closing Transmission Time</i> begins is as follows: <ul style="list-style-type: none"> <li>• For the Short pulse radar Test Signals this instant is the end of the <i>Burst</i>.</li> <li>• For the Frequency Hopping radar Test Signal, this instant is the end of the last radar <i>Burst</i> generated.</li> <li>• For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.</li> </ul> Note 2: The <i>Channel Closing Transmission Time</i> is comprised of 200 milliseconds starting at the beginning of the <i>Channel Move Time</i> plus any additional intermittent control signals required to facilitate <i>Channel</i> 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 <i>U-NII Detection Bandwidth</i> detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.	

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**Table 5: Radar Test Waveforms**

**Short Pulse Radar**

Radar Type	Pulse Width (µsec)	PRI (µsec)	Number of 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**

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of 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

**Frequency Hopping Radar**

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	.333	300	70%	30

*The applicant of this given application confirms that information regarding the parameters of the detected Radar Waveforms is not available to the end user.*

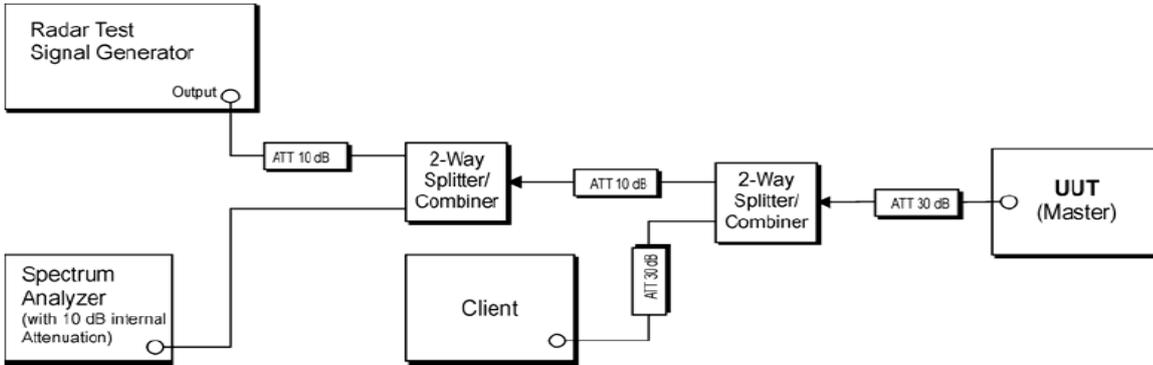
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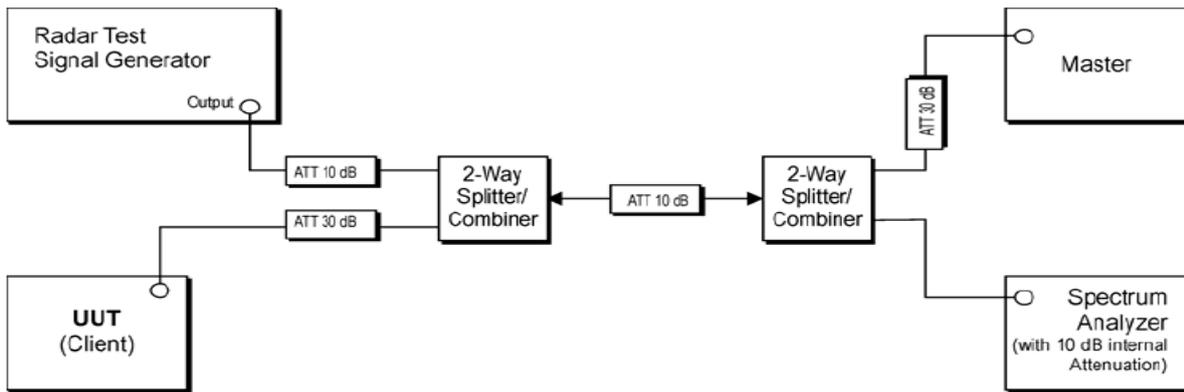
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### 4.2.2. Test Setup

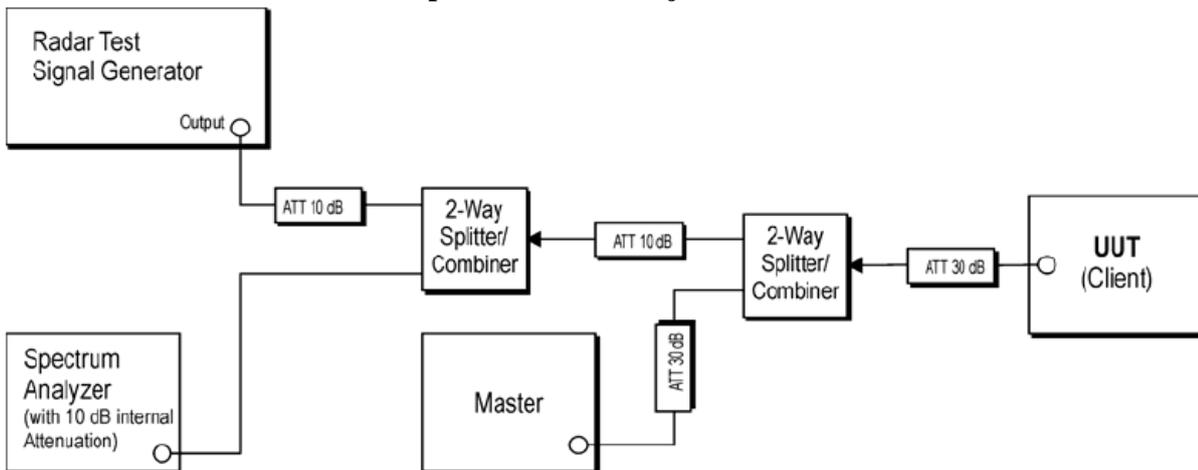
Setup for Master with injection at the Master



Setup for Client with injection at the Master



Setup for Client with injection at the Client



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**4.2.3. Test Equipment Used:**

DFS Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Signal Generator	Agilent	E4438C	MY45093613	07/30/2013	07/29/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2013	02/27/2014
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2013	02/27/2014
Power Splitter	Mini-Circuits	ZN2PD-9G-S+	N/A	02/28/2013	02/27/2014
Power Splitter	Mini-Circuits	ZN2PD-9G-S+	N/A	02/28/2013	02/27/2014
Attenuator	Agilent	8495B	3308A22470	02/28/2013	02/27/2014
Attenuator	HP	8494B	2812A170605	02/28/2013	02/27/2014

**4.2.4. Description of EUT:**

EUT operates over the 5250-5350MHz and 5470-5725MHz ranges and EUT is a slave device (client equipment) w/o radar detection and DFS capability. EUT has a gain of 0.56dBi in the 5GHz Band.

EUT has no TPC mechanism implemented with no adjustment of lowest, and highest power, but the level of power emission stays at fixed level.

The EUT utilizes the 802.11a architecture, with a nominal channel bandwidth of 20MHz

WLAN traffic is generated by streaming the mpeg file from the master to slave in full monitor video mode using the media player by configuring test lab owned laptop as IP server.

MPEG test file is located at: <http://ntiacsd.ntia.doc.gov/dfs/>.

The rated output power of the master unit is >23dBm(EIRP).therefore the required interference threshold level is -62dBm.after correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is -62dBm, and the master device as employed for the applicable DFS test is CISCO router whose FCC ID= LDK102061

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While calibrate the path on antenna port of DFS test equipment (master), measurements equipments (spectrum) is ensured to be 50 Ohms, and therefore verification on antenna gain measurement can be ignored.

Conducted test was performed with appropriate adjustment, and calibration to ensure power from DFS simulator injects to antenna port of DFS test equipment (DFS) is -62dBm

### Message or files that is used for communication between Master and Client:

IP based system:

For the required channel loading, the full motion, 30 frames per second MPEG video file from <http://ntiacsd.ntia.doc.gov/dfs/> was streamed from a network on a test bench (server of the storage to download the mandatory format of Video file), via the DFS Master device, to the UE (mobile phone).

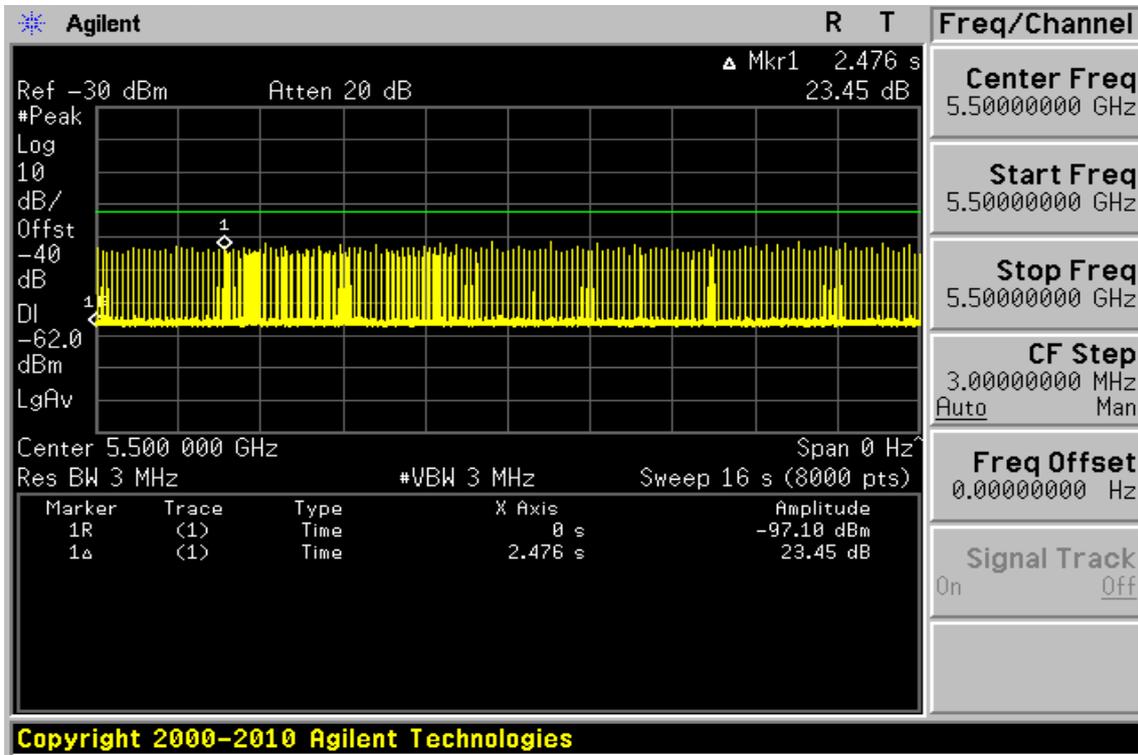
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### 4.2.5. Test results

The time of power-on cycle (2.476s):

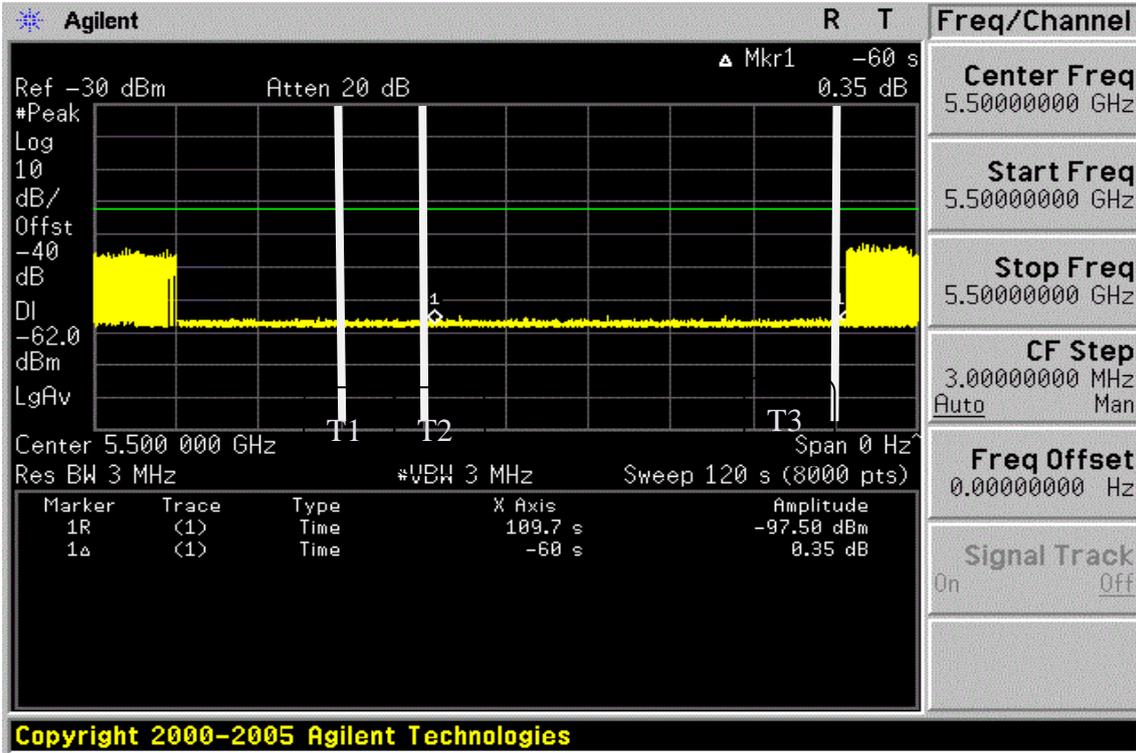


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The time of channel availability check (60s)



Where T1~T2 indicates the time to power up, where T2~T3 represents the channel availability time.

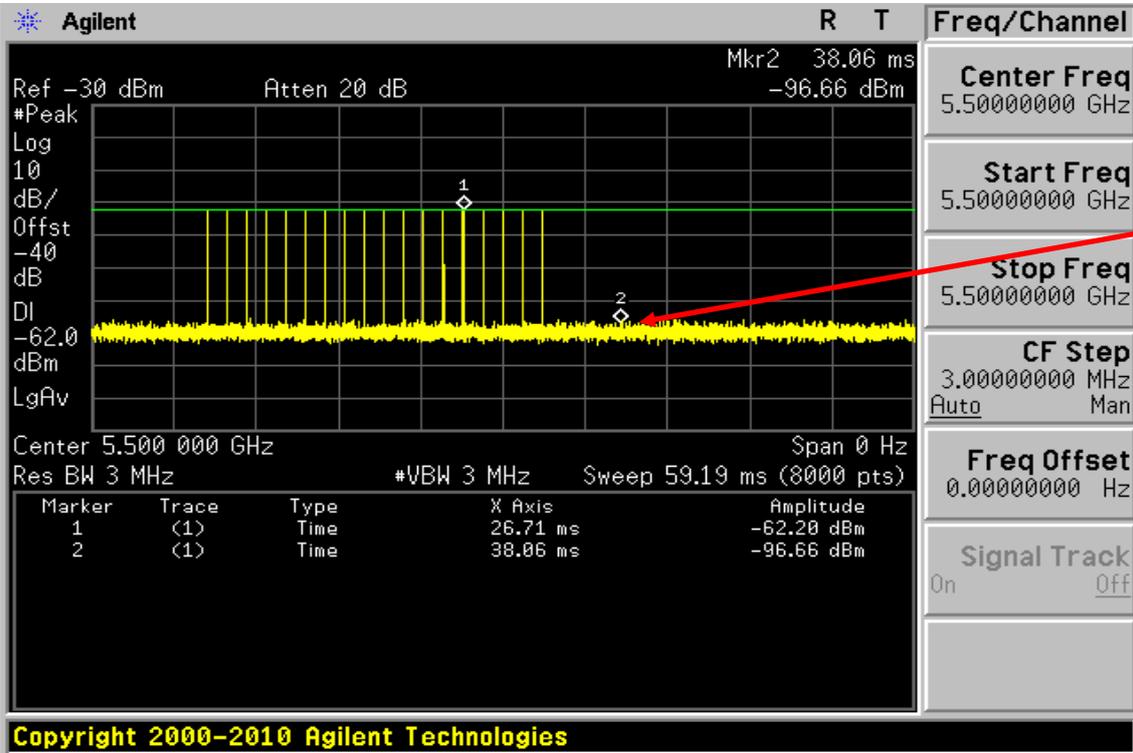
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Calibration plots for each of the required radar waveforms

Radar type 1



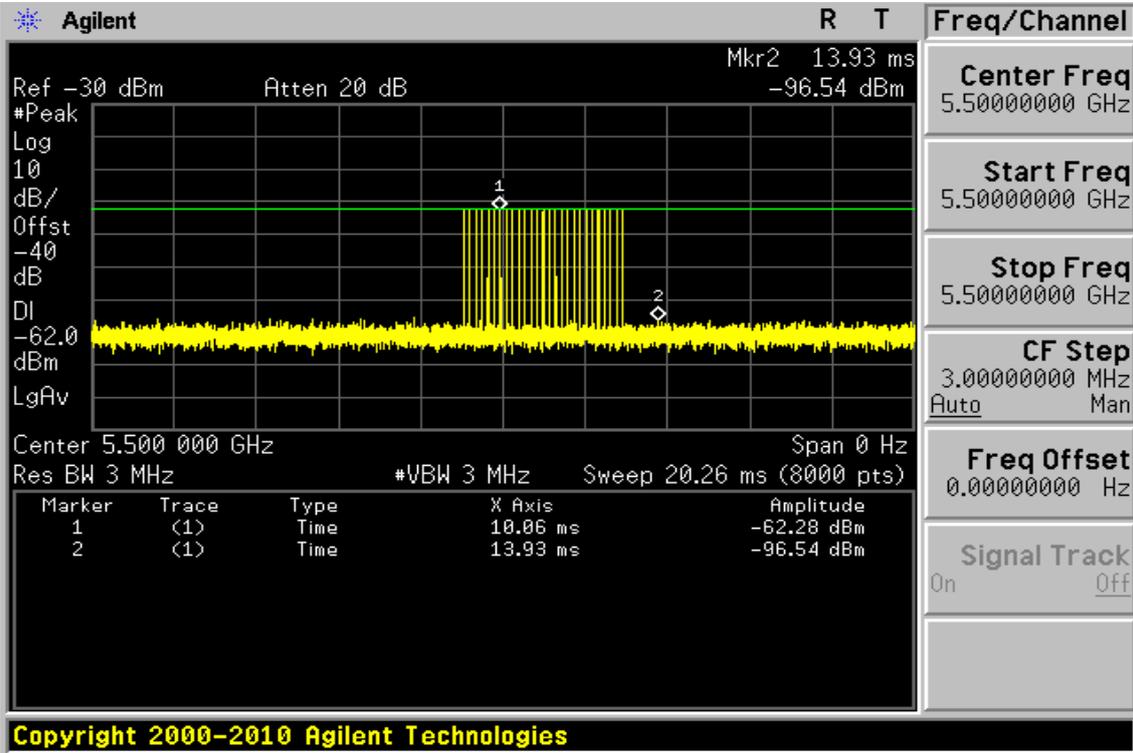
Noise Floor

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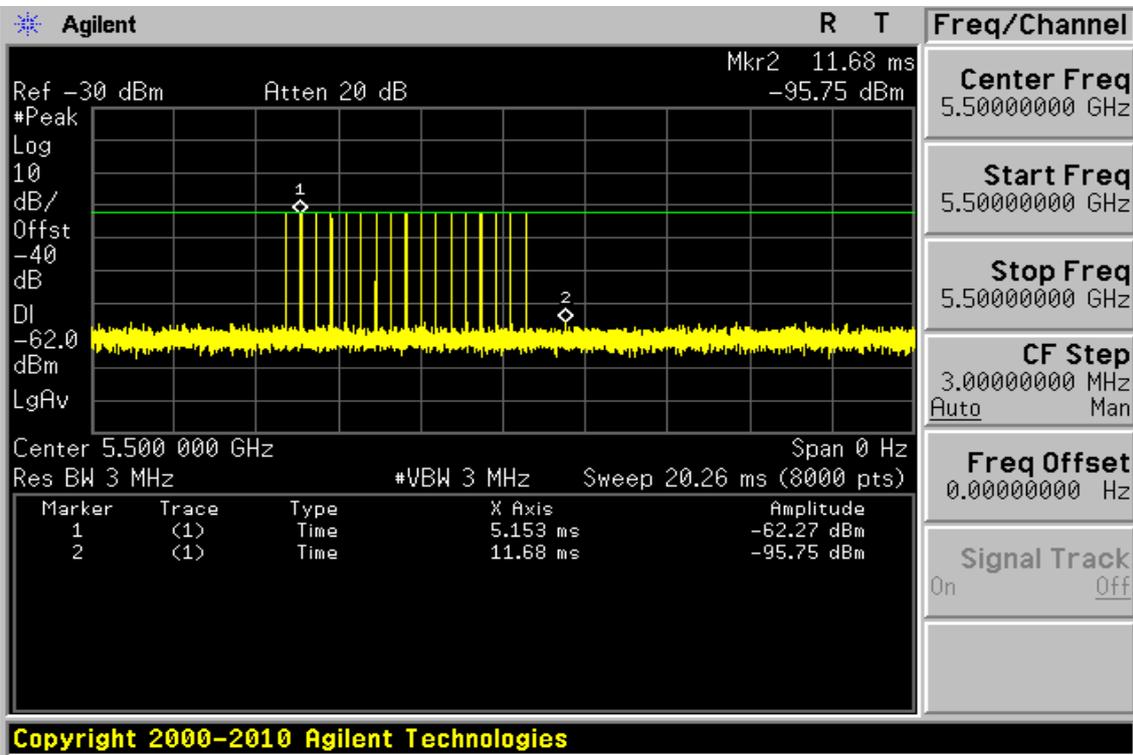
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**Radar type 2**



**Radar type 3**

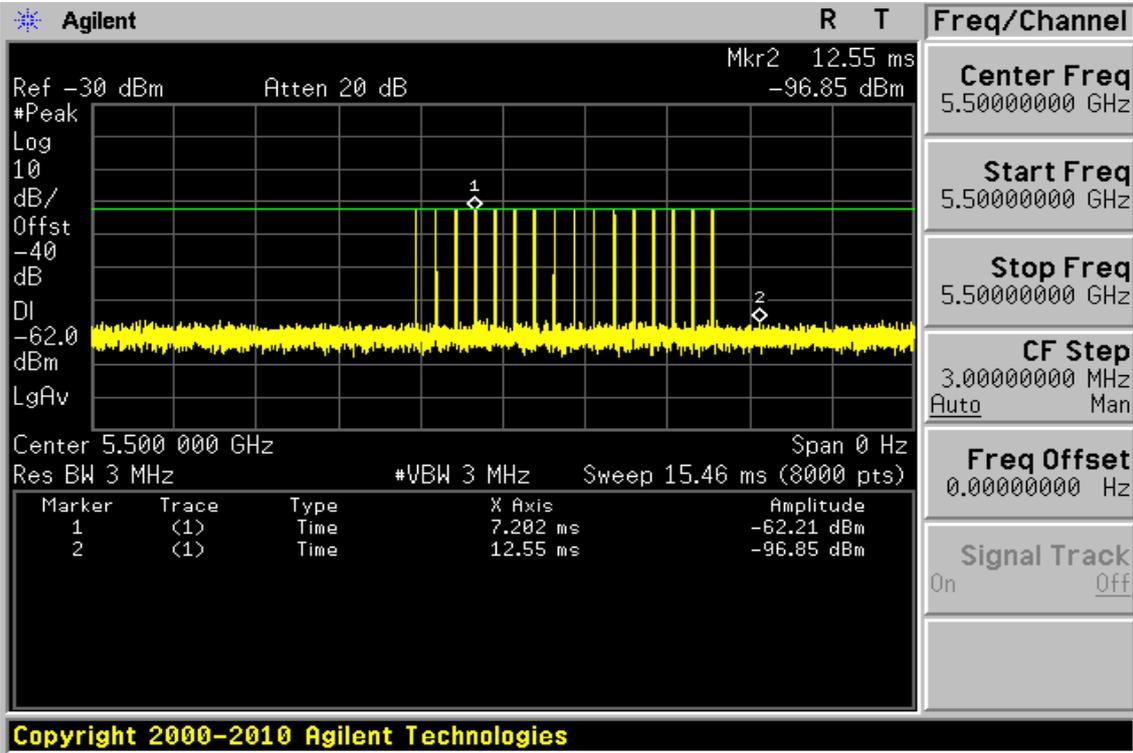


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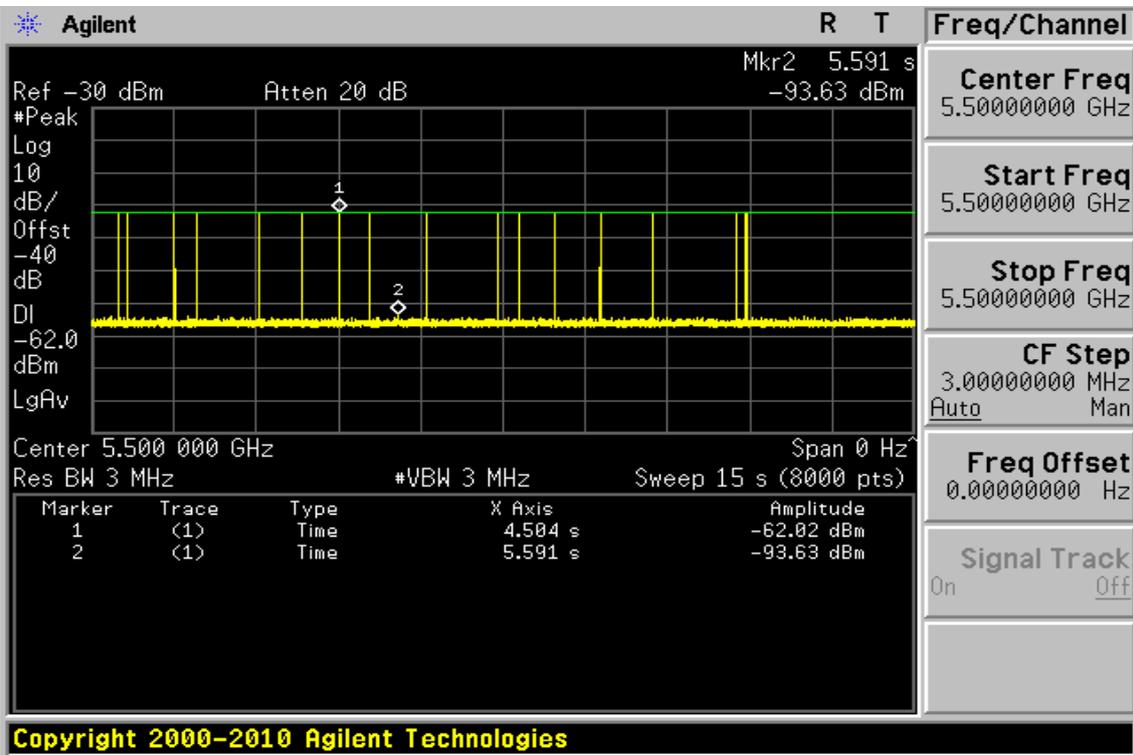
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**Radar type 4**



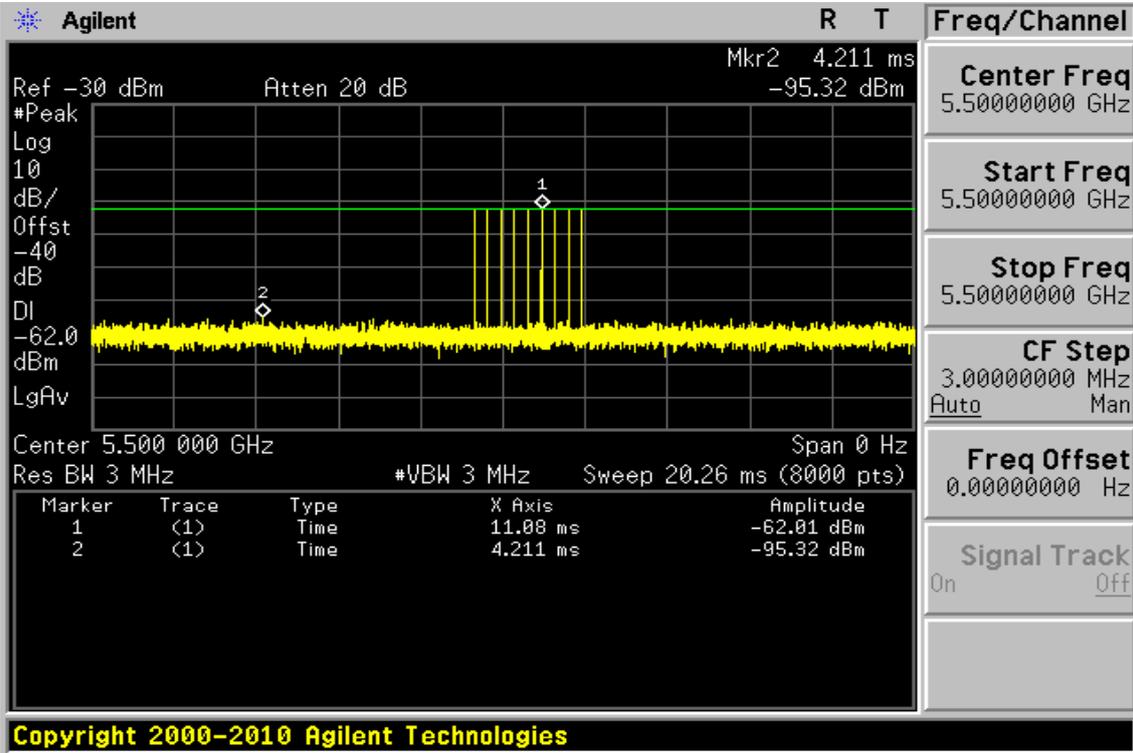
**Radar type 5**



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**Radar type 6**

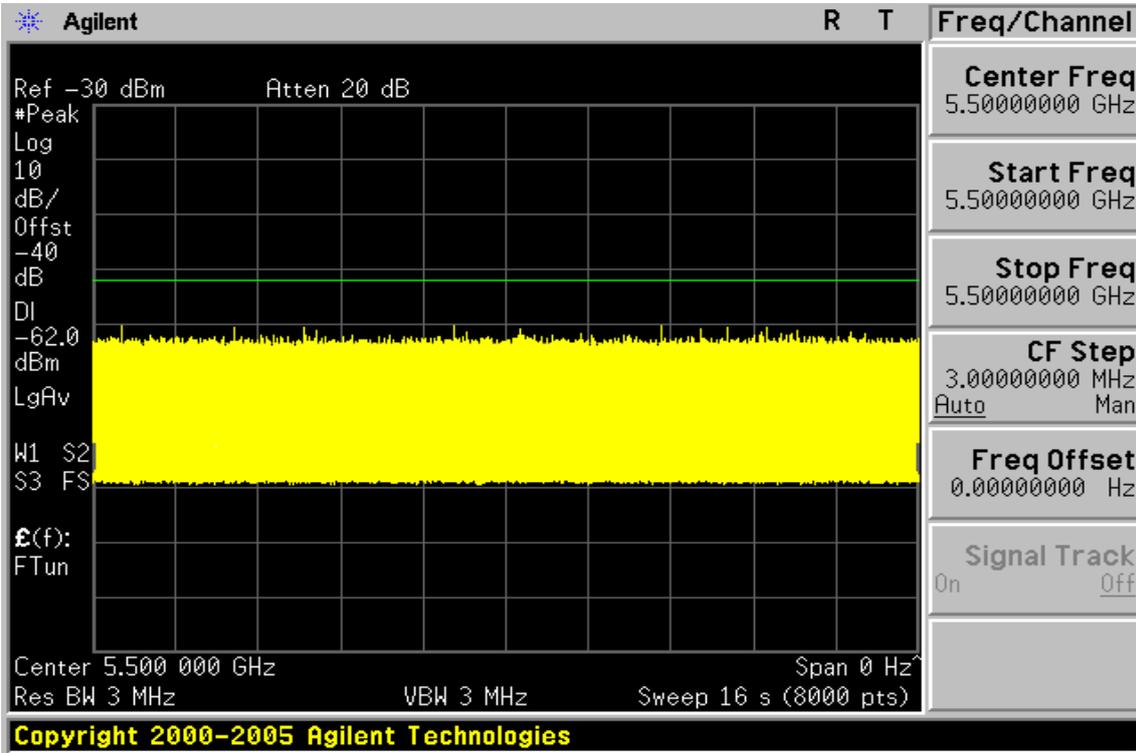


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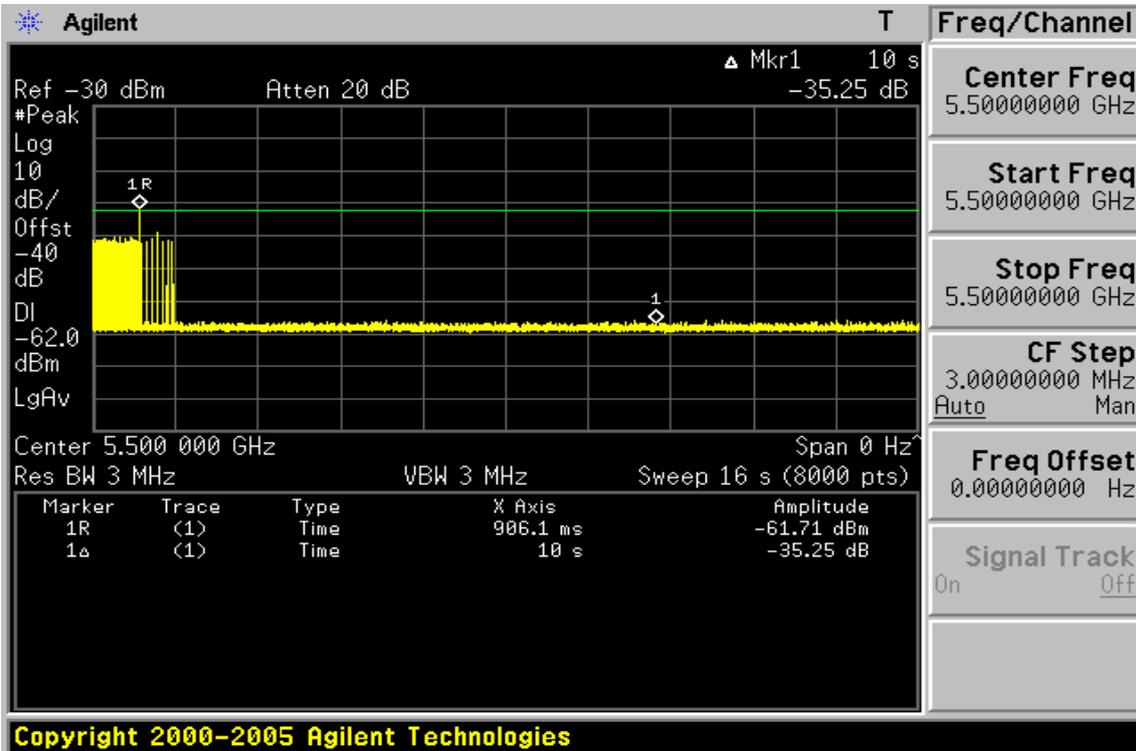
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WLAN traffic



Radar Type 1 Channel Move Time

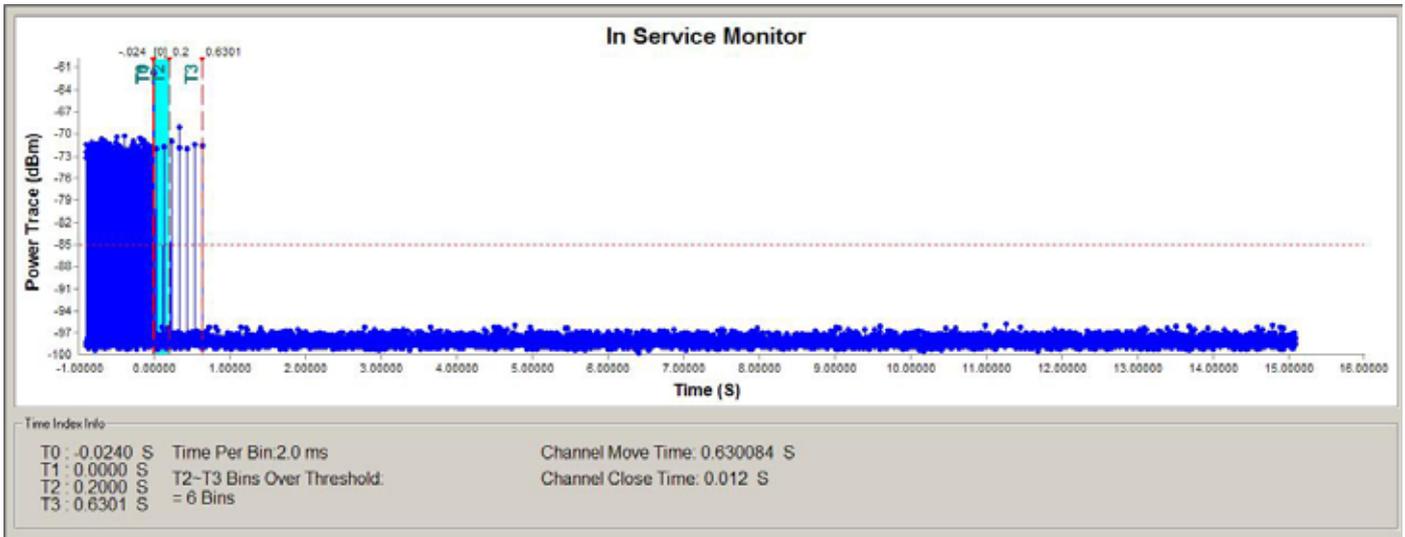


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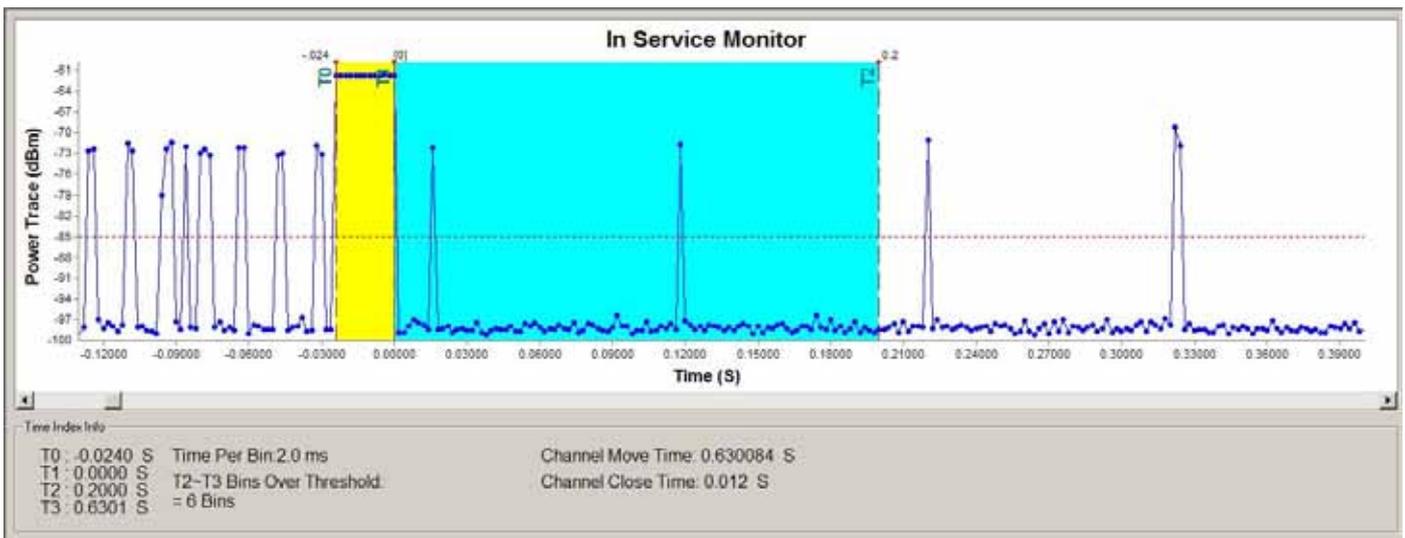
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**Radar Type 1 Channel Closing Transmission Time - 1**



**Radar Type 1 Channel Closing Transmission Time - 2**

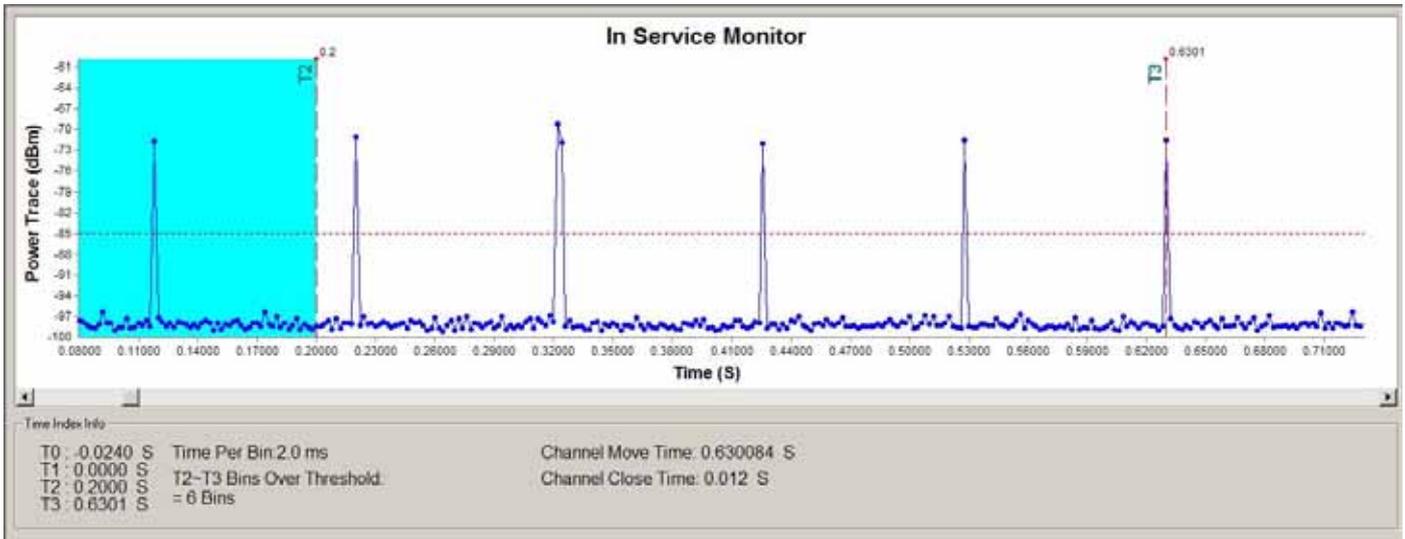


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**Radar Type 1 Channel Closing Transmission Time - 3**



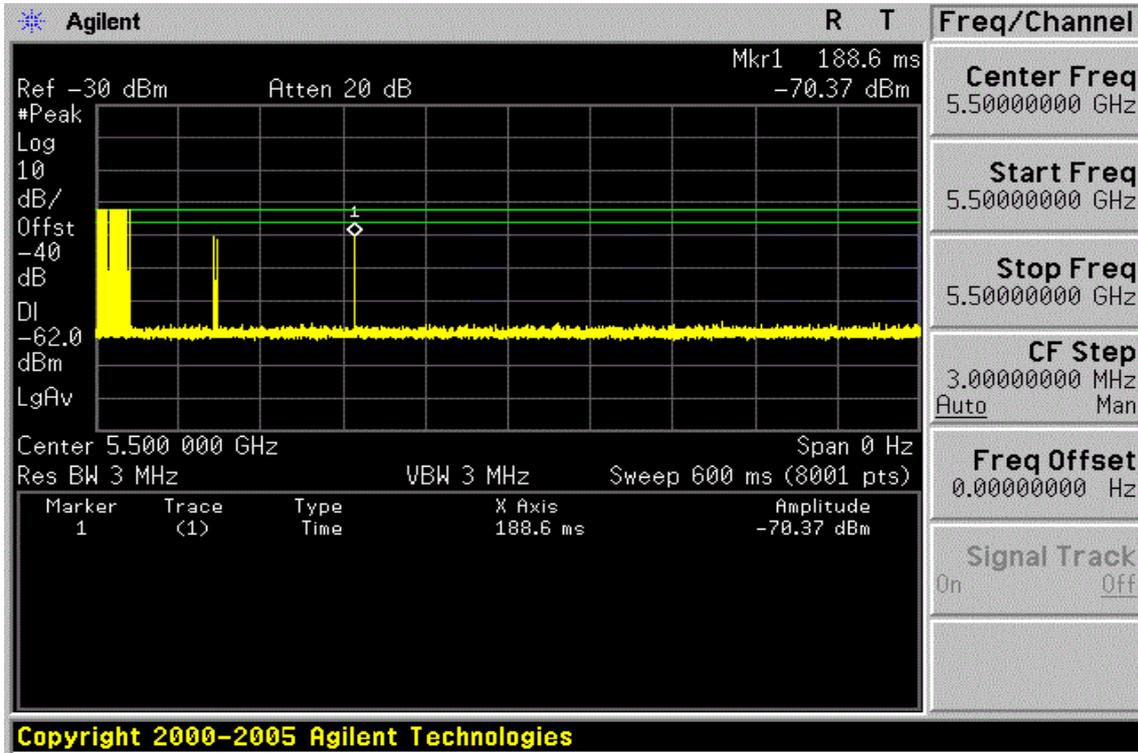
**Verdict:**

*Time per bin: 2.0ms, Total Bins after 200ms: 6Bins, Total time intermittent control remains: 12.0ms. 12.0ms < 60ms in the period of 10s.*

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**Radar Type 1 Channel Closing Transmission Time - 4**



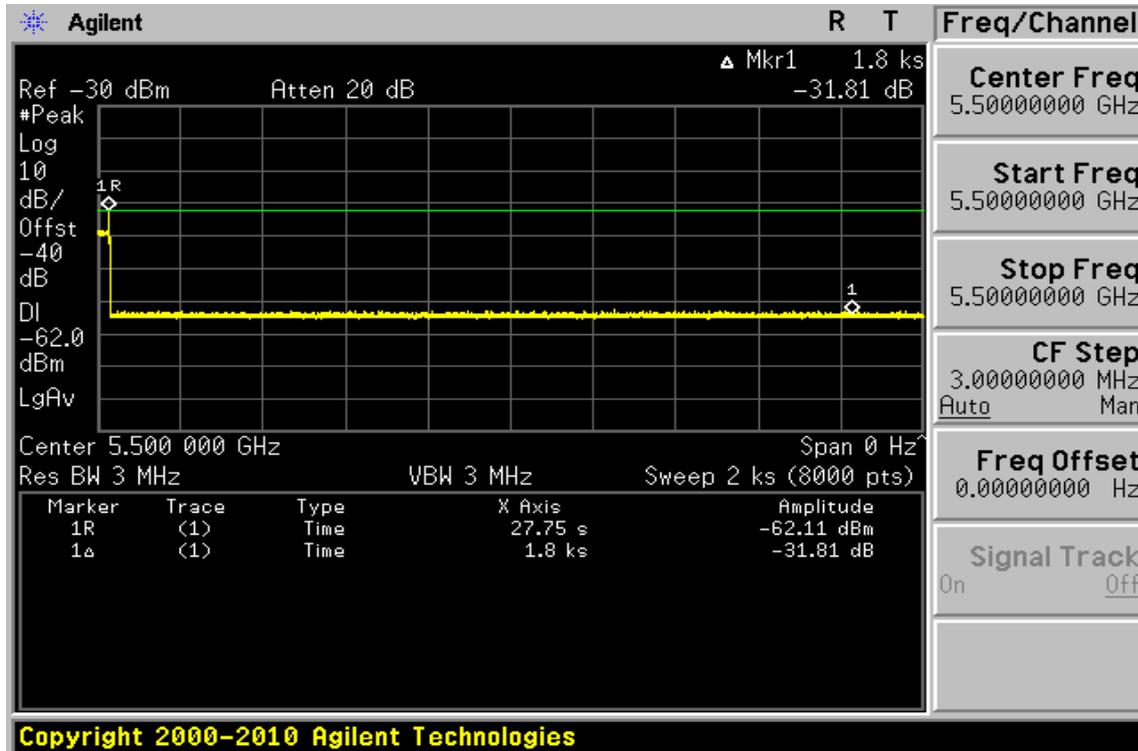
**Verdict:**

*Note: narrowing the sweep time as the good engineering process for the verification of transmission closing in 200ms*

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**Non-occupancy Period (without radar detection)**



**Verdict:**

*To verify whether channel is unavailable to be operated in 30 minutes.*

$$1.8ks = 1800s = 1800 s/min /60 = 30minute$$

*~ End of Report ~*

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