ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART E REQUIREMENT DFS TEST REPORT

OF

Product Name:	**Tablet PC**
Brand Name:	**hp**
Model No.:	**HSTNN-Q93C**
FCC ID:	**B94HNQ93CSPN**
Report No.:	**E2/2015/30063**
Issue Date:	**Apr. 30, 2015**
Prepared for:	**Hewlett-Packard Company 1501 Page Mill Road, M/S1419, Palo Alto, CA 94304, United States**
Prepared by:	**SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333**

ilac-MRA TAF Testing Laboratory 0513

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VERIFICATION OF COMPLIANCE

Applicant:	Hewlett-Packard Company 1501 Page Mill Road, M/S1419, Palo Alto, CA, 94304, United States
Product Name:	Tablet PC
Brand Name:	hp
Model No.:	HSTNN-Q93C
FCC ID:	B94HNQ93CSPN
File Number:	E2/2015/30063
Date of test:	Mar. 16, 2015 ~ Apr. 13, 2015
Date of EUT Received:	Mar. 16, 2015

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 ANSI C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

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

Test By:	Jazz Huang	***Date:***	Apr. 30, 2015
	Jazz Huang /Asst. Supervisor		
Prepared By:	Violetta Tang	***Date:***	Apr. 30, 2015
	Violetta Tang / Clerk		
Approved By:	Jim Chang	***Date:***	Apr. 30, 2015
	Jim Chang / Asst. Manager		

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Revision History

Report Number	Revision	Description	Issue Date
E2/2015/30063	Rev.00	Initial creation of document	Apr. 30, 2015

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1. GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	Tablet PC	
Brand Name:	hp	
Model No.:	HSTNN-Q93C	
Product SW/HW version	Win 8.1 / 1.0	
Radio SW/HW version	7.7.2.0 / 1.0	
Power Supply:	3.8Vdc form Rechargeable Li-ion Battery or 5.25V from AC/DC Adapter	
	Battery:	1. Model No.: HSTNH-C408M-SD, Supplier: Dynapack
		2. Model No.: HSTNH-C408M-SS, Supplier: SDI (SQ)
	Adapter:	1. Model No.: TPN-AA01, Supplier: AcBel
		2. Model No.: TPN-DA01, Supplier: Delta
		3. Model No.: TPN-LA01, Supplier: Lite-On

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WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Rated Power (Avg.)	Modulation Technology
11a	5150~5250	4	12.41dBm	OFDM
	5250~5350	4	12.41dBm	
	5470~5725	11	12.39dBm	
	5725-5850	5	12.45dBm	
11n / ac	HT20 / VHT20 5150~5250	4	HT: 12.43dBm VHT: 12.34dBm	OFDM
	HT20 / VHT20 5250~5350	4	HT: 12.23dBm VHT: 12.10dBm	
	HT20 / VHT20 5470~5725	11	HT: 12.42dBm VHT: 12.23dBm	
	HT20 / VHT20 5725-5850	5	HT: 12.43dBm VHT: 12.30dBm	
11n / ac	HT40 / VHT40 5150~5250	2	HT: 12.25dBm VHT: 12.30dBm	OFDM
	HT40 / VHT40 5250~5350	2	HT: 12.24dBm VHT: 12.32dBm	
	HT40 / VHT40 5470~5725	5	HT: 12.26dBm VHT: 12.44dBm	
	HT40 / VHT40 5725-5850	2	HT: 12.27dBm VHT: 12.39dBm	
11ac	VHT80 5150~5250	1	12.15dBm	OFDM
	VHT80 5250~5350	1	12.04dBm	
	VHT80 5470~5725	3	12.05dBm	
	VHT80 5725-5850	1	12.12dBm	

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Antenna Designation	PIFA Antenna Main: Part No.: DQ6R15GAV00, Supplier: Wistron Neweb Corp 5GHz Gain: -4.47dBi (5150MHz-5250MHz) 5GHz Gain: -4.48dBi (5250MHz-5350MHz) 5GHz Gain: -2.13dBi (5470MHz-5725MHz) 5GHz Gain: -3.57dBi (5725MHz-5850MHz) Aux: Part No.: DQ6R15GAW00, Supplier: Wistron Neweb Corp 5GHz Gain: -0.51dBi (5150MHz-5250MHz) 5GHz Gain: -0.64dBi (5250MHz-5350MHz) 5GHz Gain: -0.44dBi (5470MHz-5725MHz) 5GHz Gain: -2.09dBi (5725MHz-5850MHz)
Modulation type	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 – 65Mbps 802.11 n_40MHz: 13.5 – 135Mbps 802.11 ac_20MHz: 6.5 – 65Mbps 802.11 ac_40MHz: 13.5 – 135Mbps 802.11 ac_80MHz: 29.3 – 292.5Mbps

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1.2 Product Feature of Equipment Under Test

The equipment under Test (Hereafter Called: EUT) is Tablet PC supporting Wi-Fi 802.11abgn & ac, Bluetooth with NFC features, and below is details of information.

Product Feature	
Product Name:	Tablet PC
Brand Name:	hp
Model No.:	HSTNN-Q93C
FCC ID	B94HNQ93CSPN
Wi-Fi Specification	802.11a/b/g/n/ac
Bluetooth Version	V4.0 dual mode + HS
NFC Specification	NFC

Note: The above EUT information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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1.3 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407

FCC KDB 905462

All test items have been performed and record as per the above standards.

1.4 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan. (TAF code 0513)

FCC Registration Numbers are: 628985

Canada Registration Number: 4620A-5

1.5 Special Accessories

There are no special accessories used while test was conducted.

1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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2. SUMMARY OF TEST RESULT

FCC / IC 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	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, 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) and FCC KDB 905462 D02 , Radar Detection Function of Dynamic Frequency Selection (DFS).

Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. Operators shall only use equipment with a DFS mechanism that is turned on when operating in these bands. The device must sense for radar signals at 100 percent of its emission bandwidth. The minimum DFS detection threshold for devices with a maximum e.i.r.p. of 200mW to 1 W is −64dBm. For devices that operate with less than 200mW e.i.r.p. and a power spectral density of less than 10dBm in a 1 MHz band, the minimum detection threshold is −62dBm. The detection threshold is the received power averaged over 1 microsecond referenced to a 0dBi antenna. For the initial channel setting, the manufacturers shall be permitted to provide for either random channel selection or manual channel selection.

(i) Operational Modes. The DFS requirement applies to the following operational modes:

(A) The requirement for channel availability check time applies in the master operational mode.

(B) The requirement for channel move time applies in both the master and slave operational modes.

(ii) 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.

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(iii) Channel Move Time. After a radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.

(iv) 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.

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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
U-NII Detection Band-width	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
Cannel Closing Transmission time	Yes	Yes
Channel Move time	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required

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Additional requirements for devices with multiple bandwidth mode	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.		

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Table 3: Interference Threshold values, Master or Client incorporating In-Service Monitoring

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.	

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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 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.					

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 Number of 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 Number of Trials
6	1	333	9	0.333	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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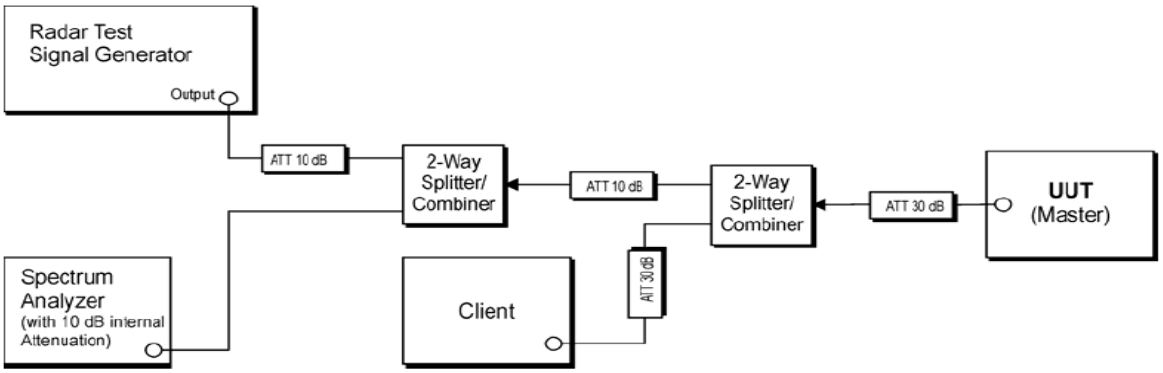
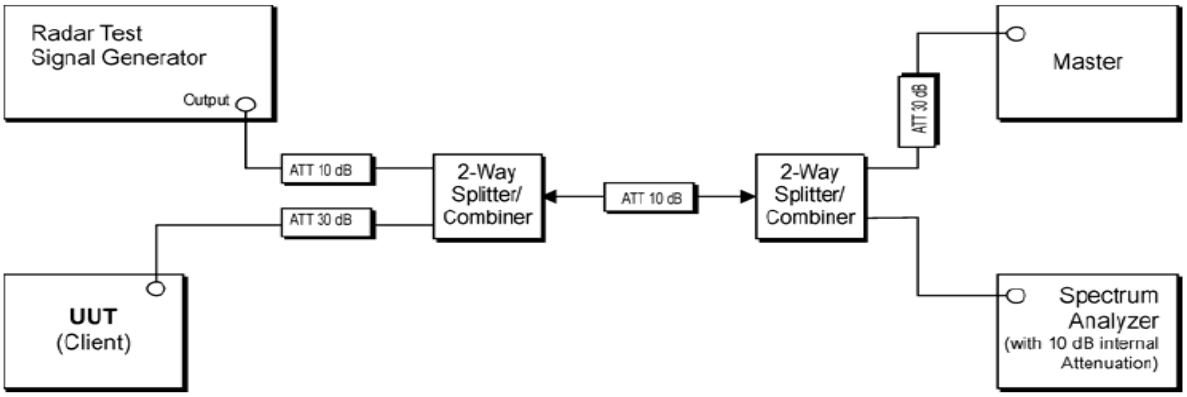
4.2.2. Test Setup

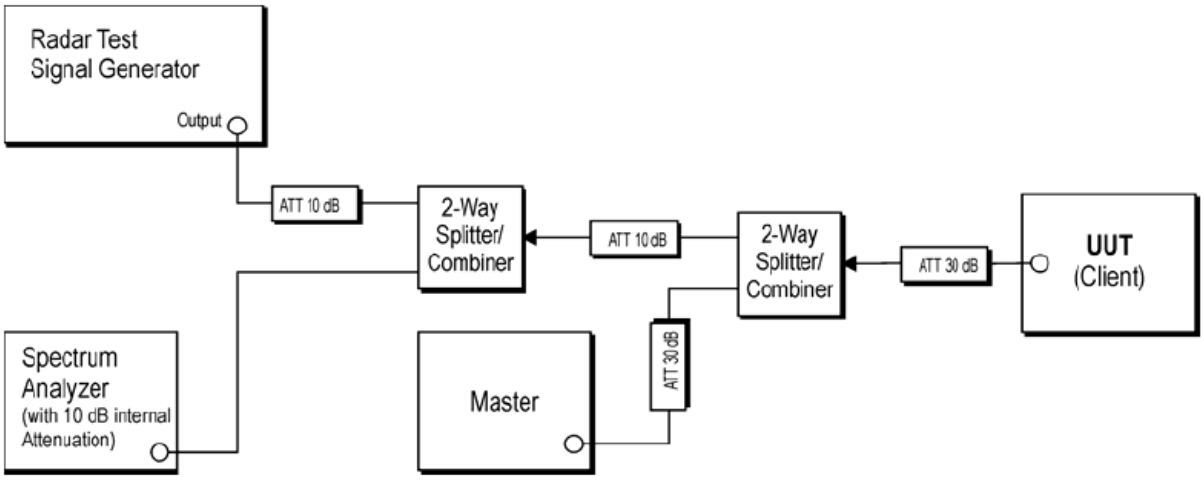
Setup for Master with injection at the Master



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:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY53400256	10/15/2014	10/14/2015
Signal Generator	R&S	SMU200A	105303	12/22/2014	12/21/2015
DC Block	PASTERNACK	PE8210	RF29	12/19/2014	12/18/2015
Attenuator	WOKEN	218FS-10	RF23	12/19/2014	12/18/2015
Splitter	Marvelous	MVE8576	RF37	12/19/2014	12/18/2015
Splitter	Marvelous	MVE8576	RF38	12/19/2014	12/18/2015
Attenuator	WOKEN	6SR1211	RF41	12/19/2014	12/18/2015

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 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 40MHz
WLAN traffic is generated by streaming the mpeg file from the master to slave in full monitor video mode using the media player.

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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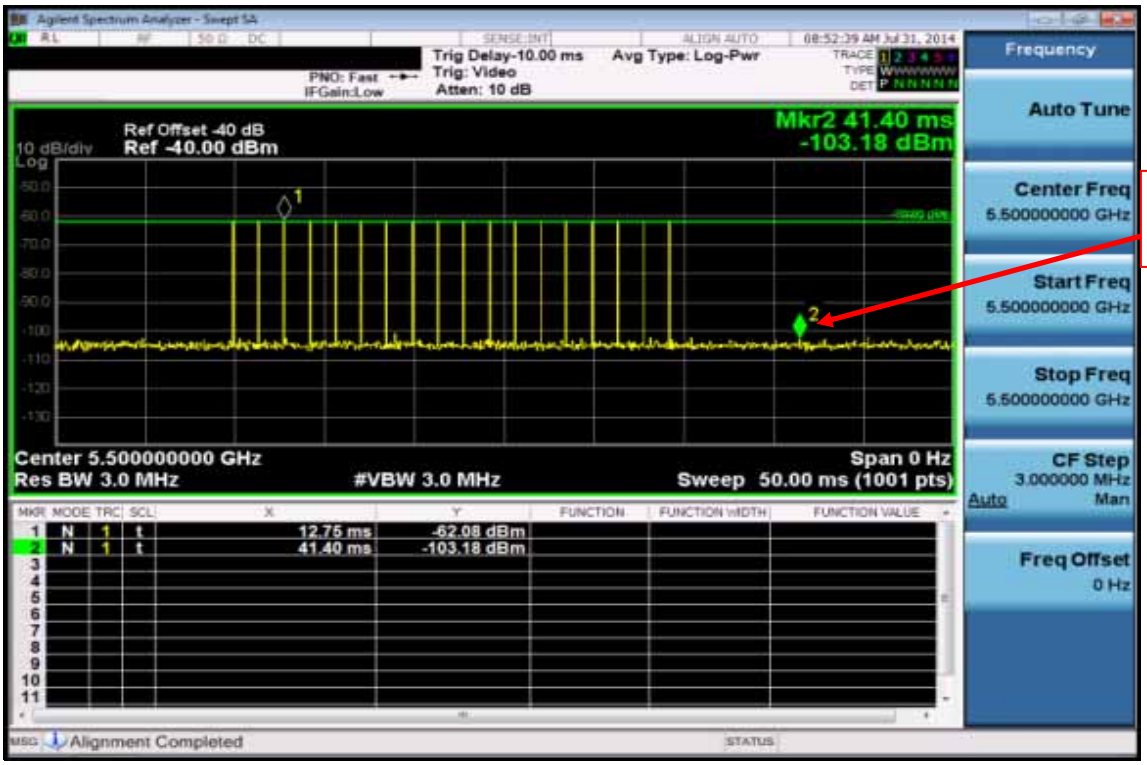
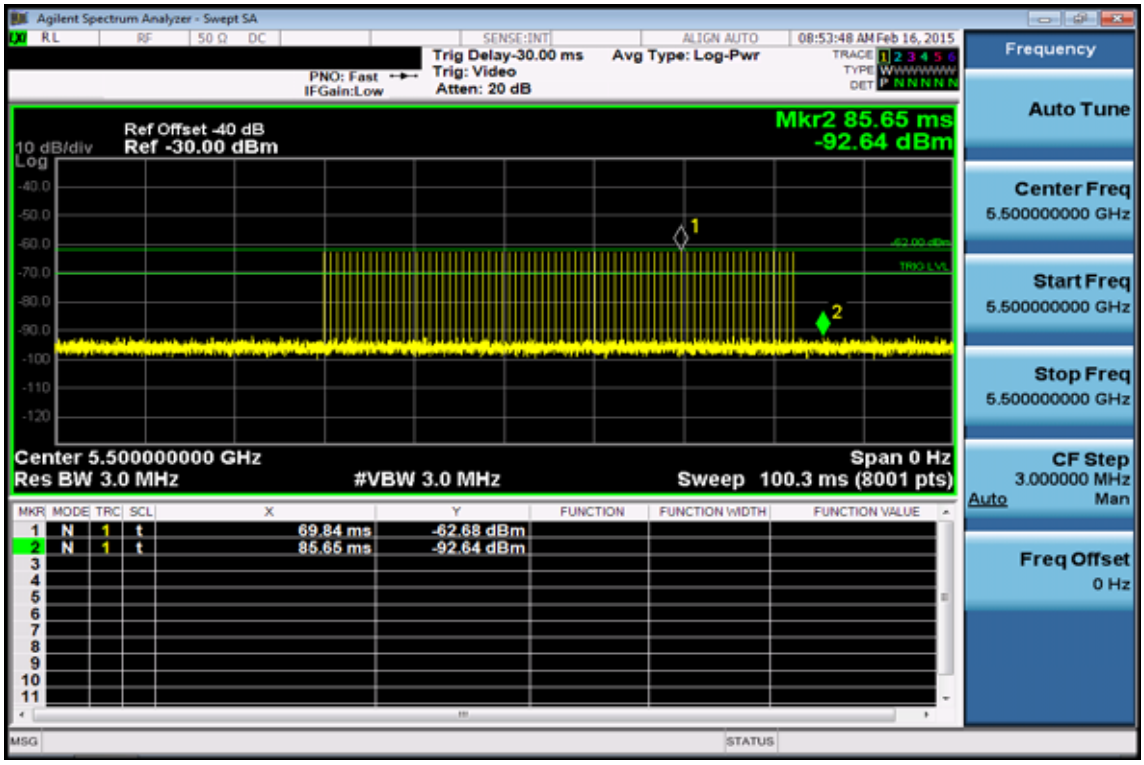
4.2.5. Test results

Calibration plots for each of the required radar waveforms

Radar type 0



Radar type 1-A



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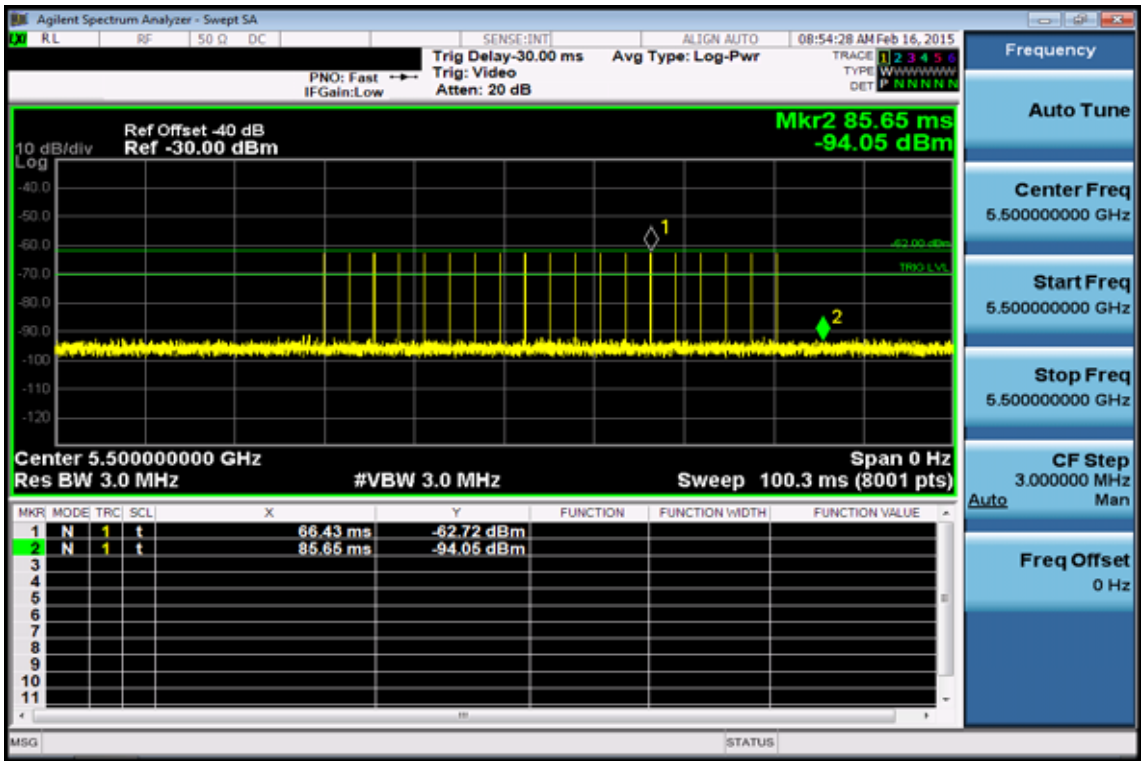
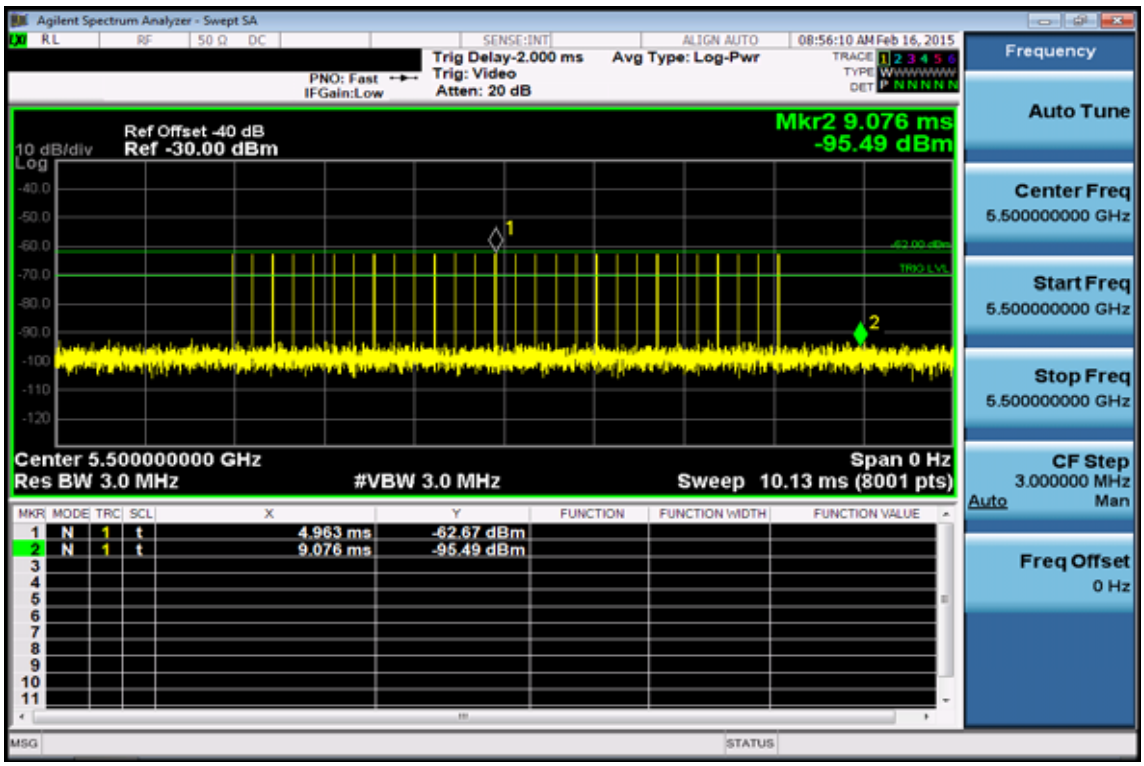
Radar type 1-B



Radar type 2



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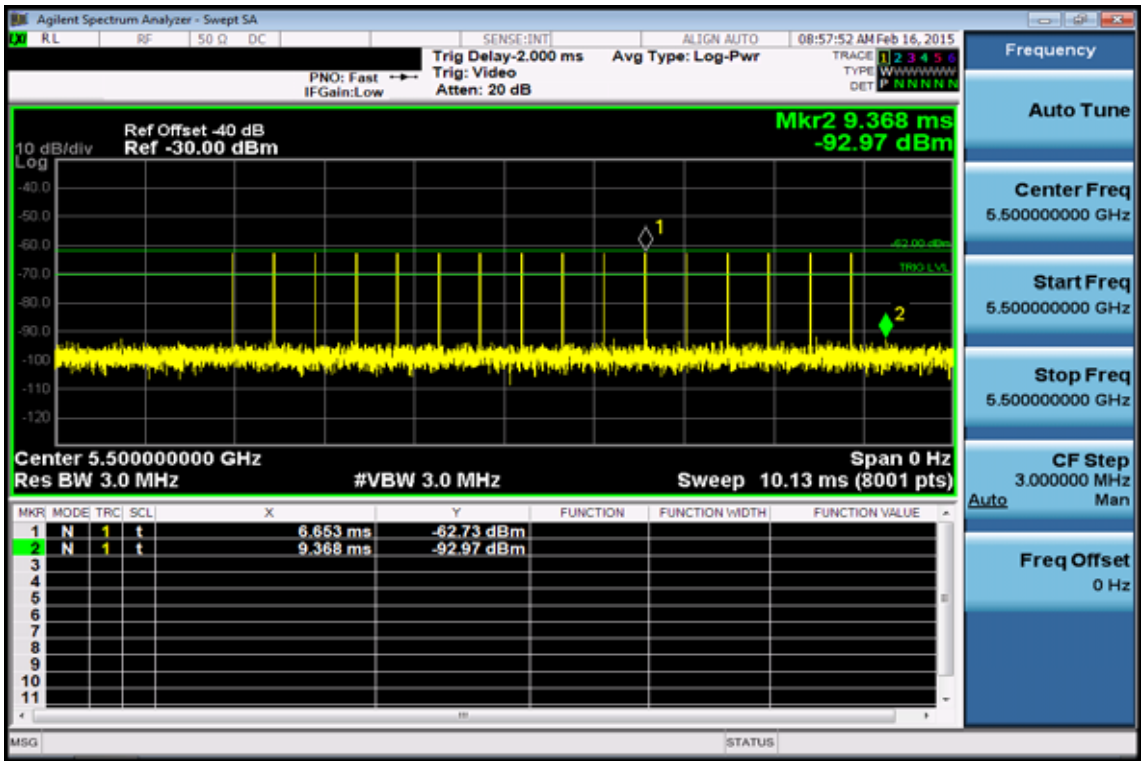
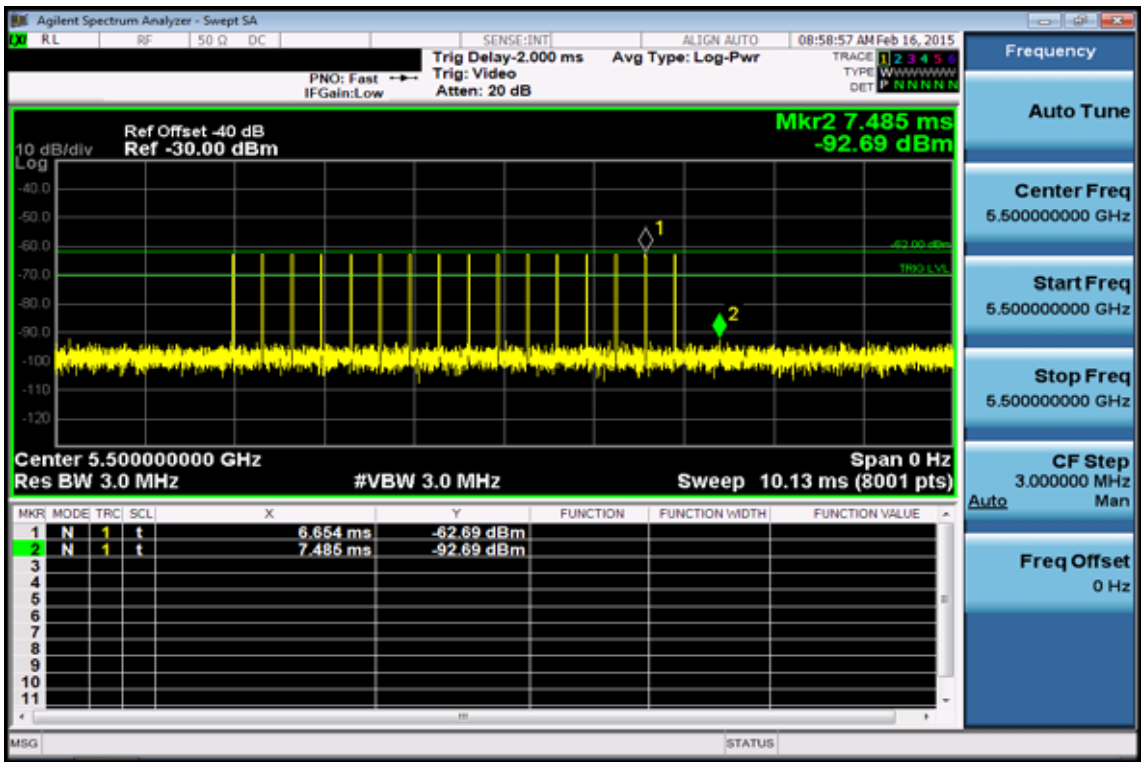
Radar type 3



Radar type 4



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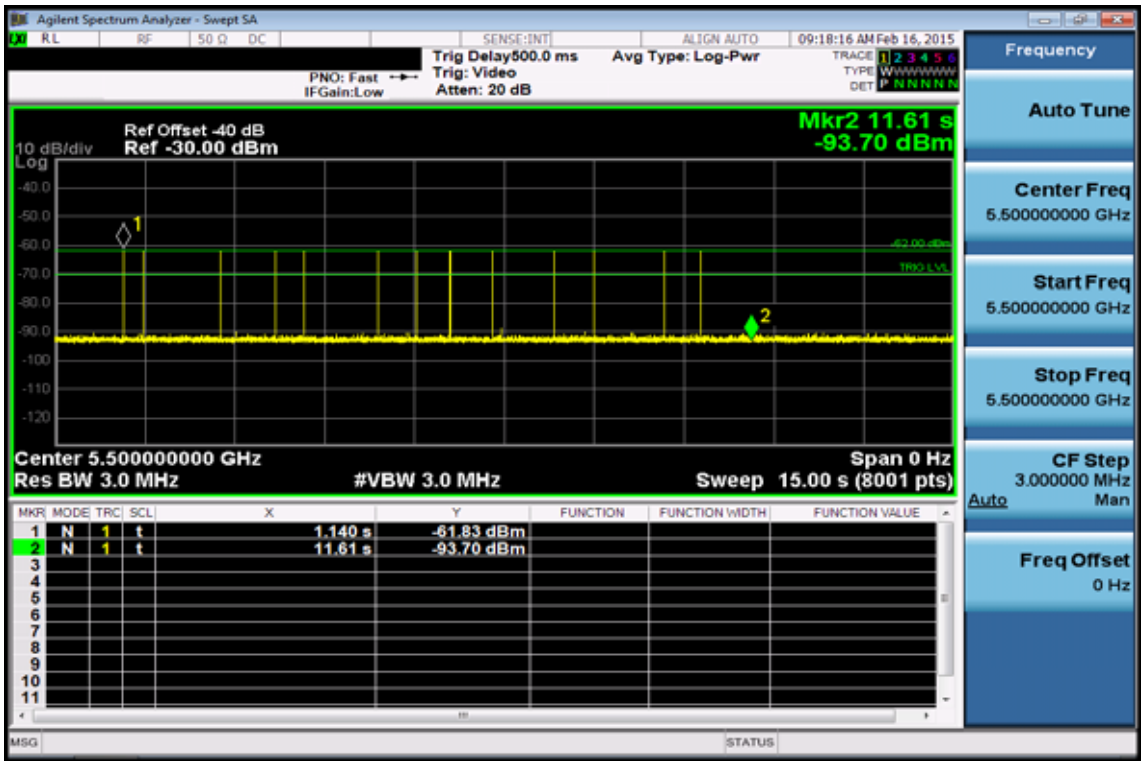
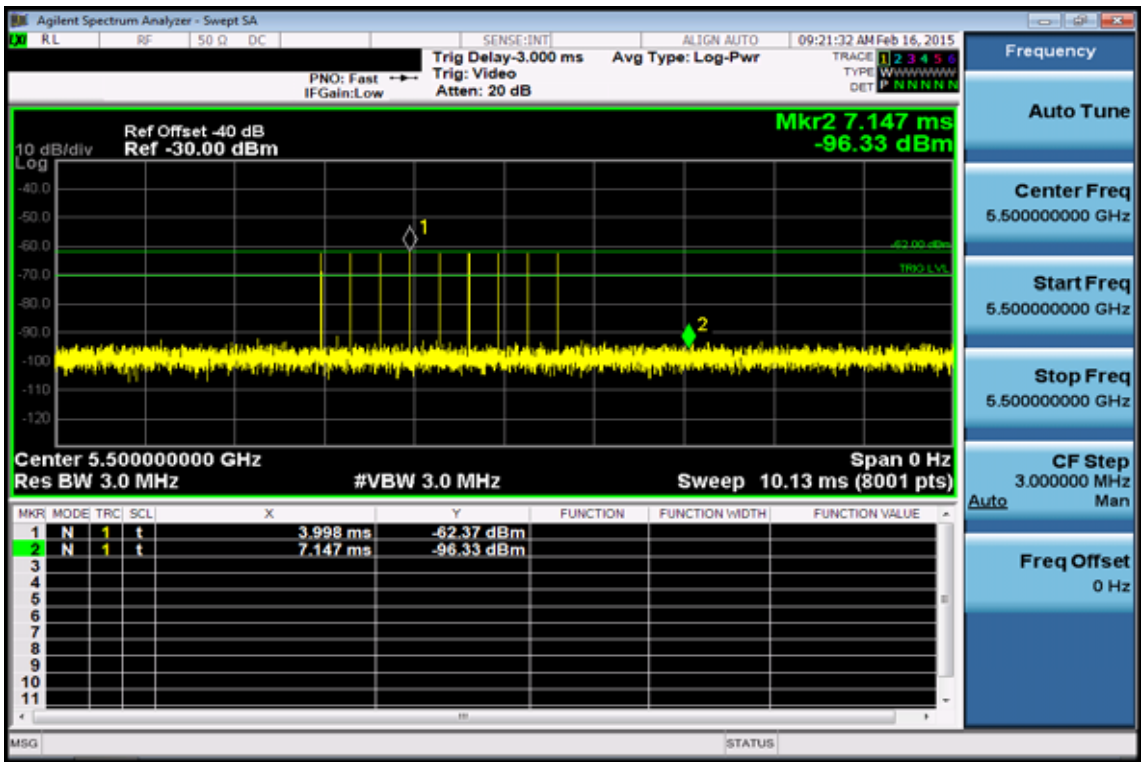
Radar type 5



Radar type 6



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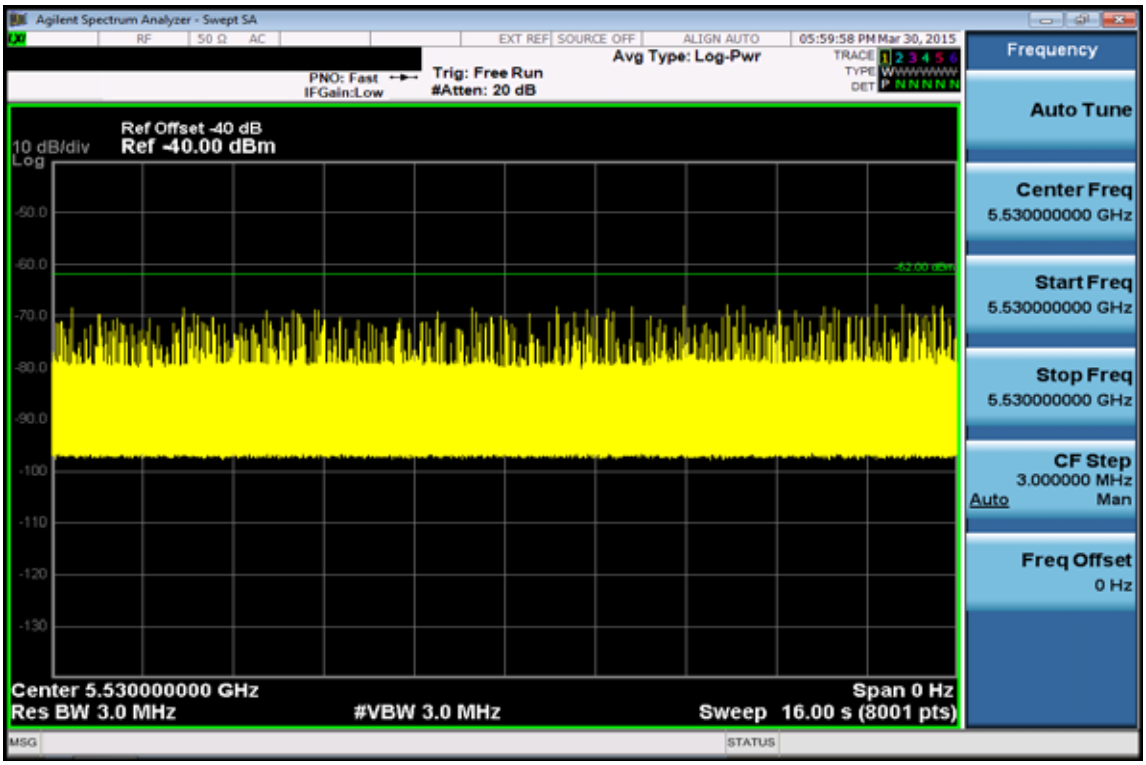
WLAN traffic



Radar Type 1 Channel Move Time

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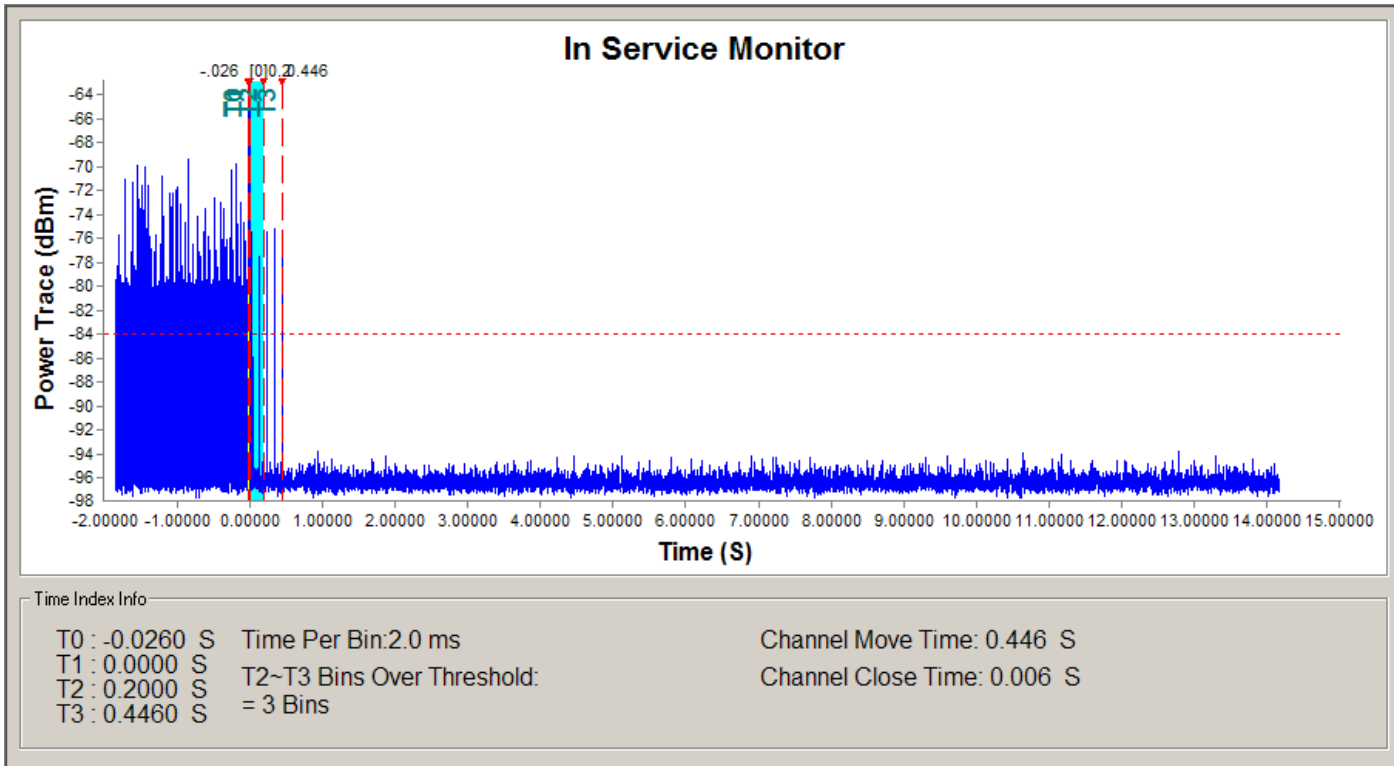
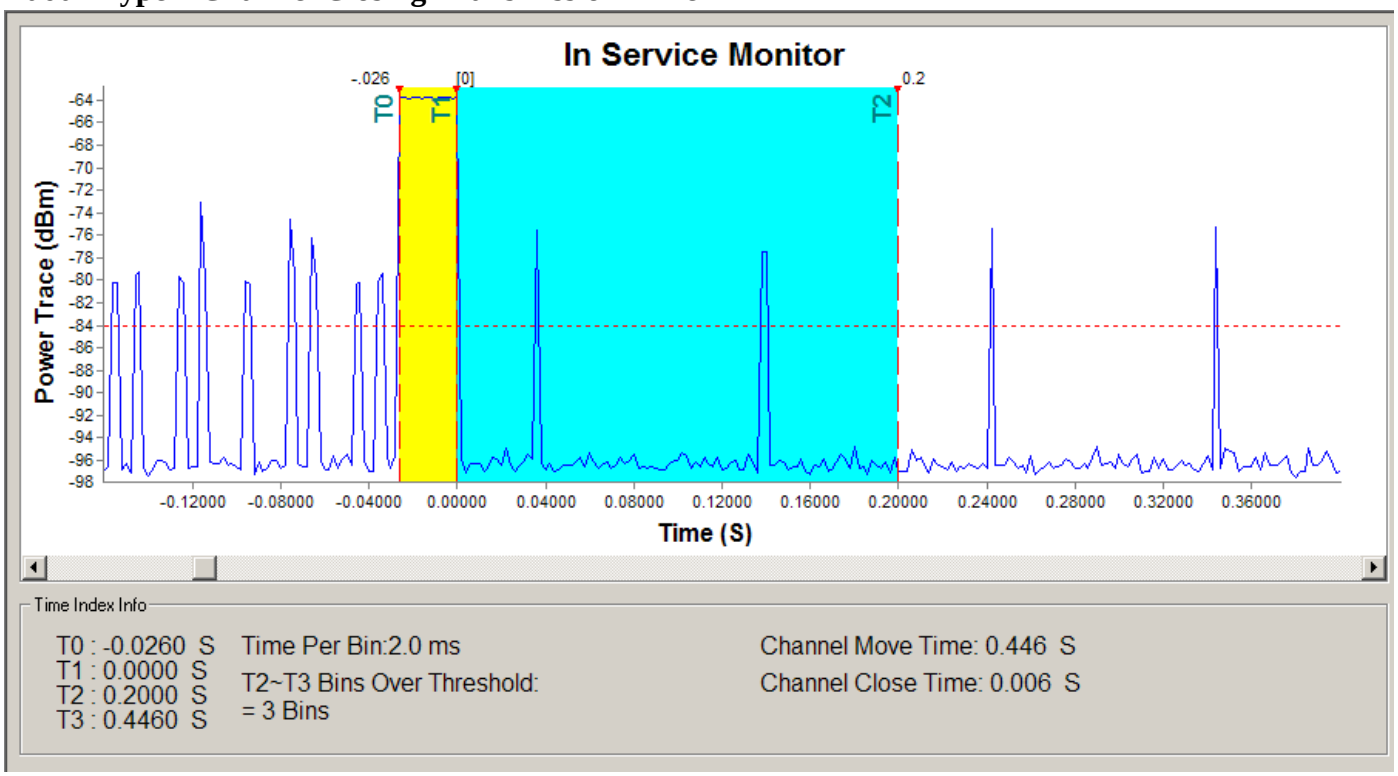
Radar Type 1 Channel Closing Transmission Time - 1



Radar Type 1 Channel Closing Transmission Time - 2



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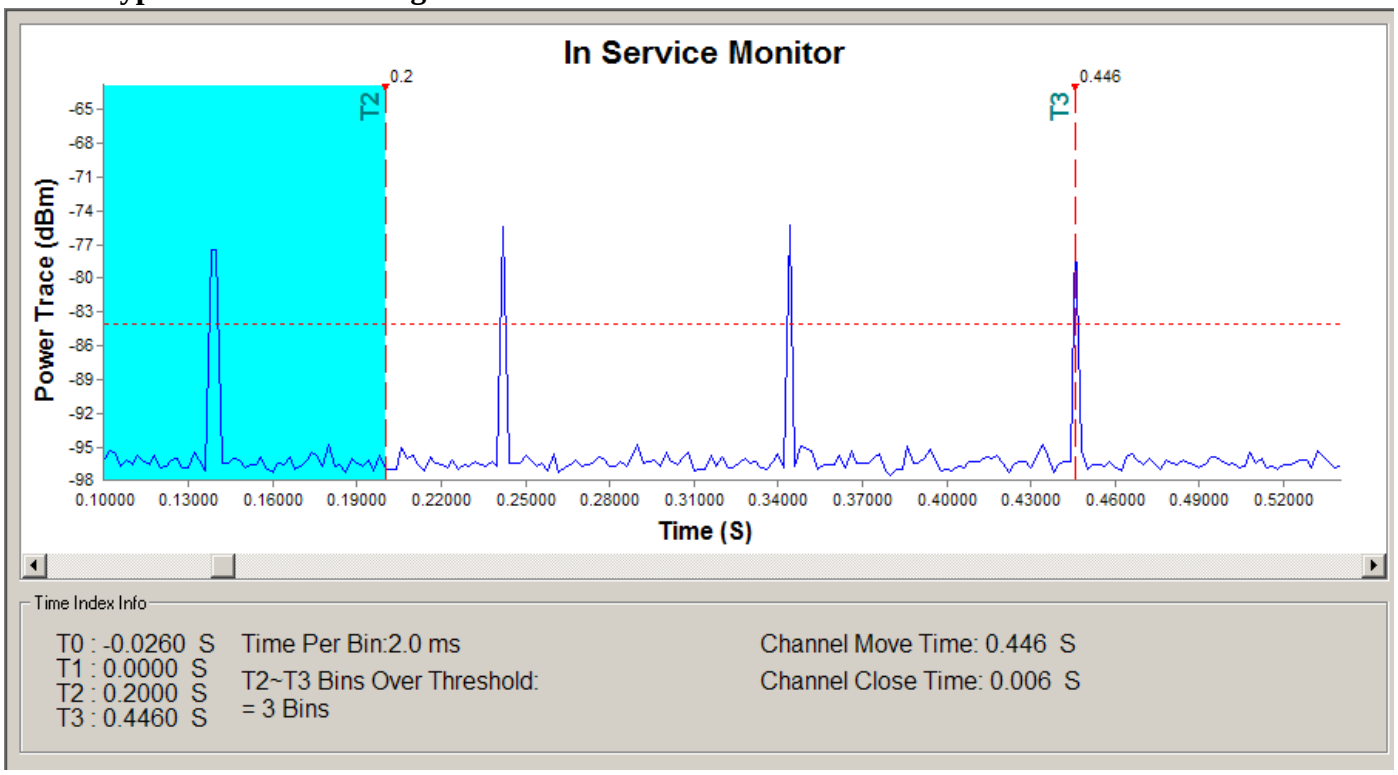
Radar Type 1 Channel Closing Transmission Time - 3



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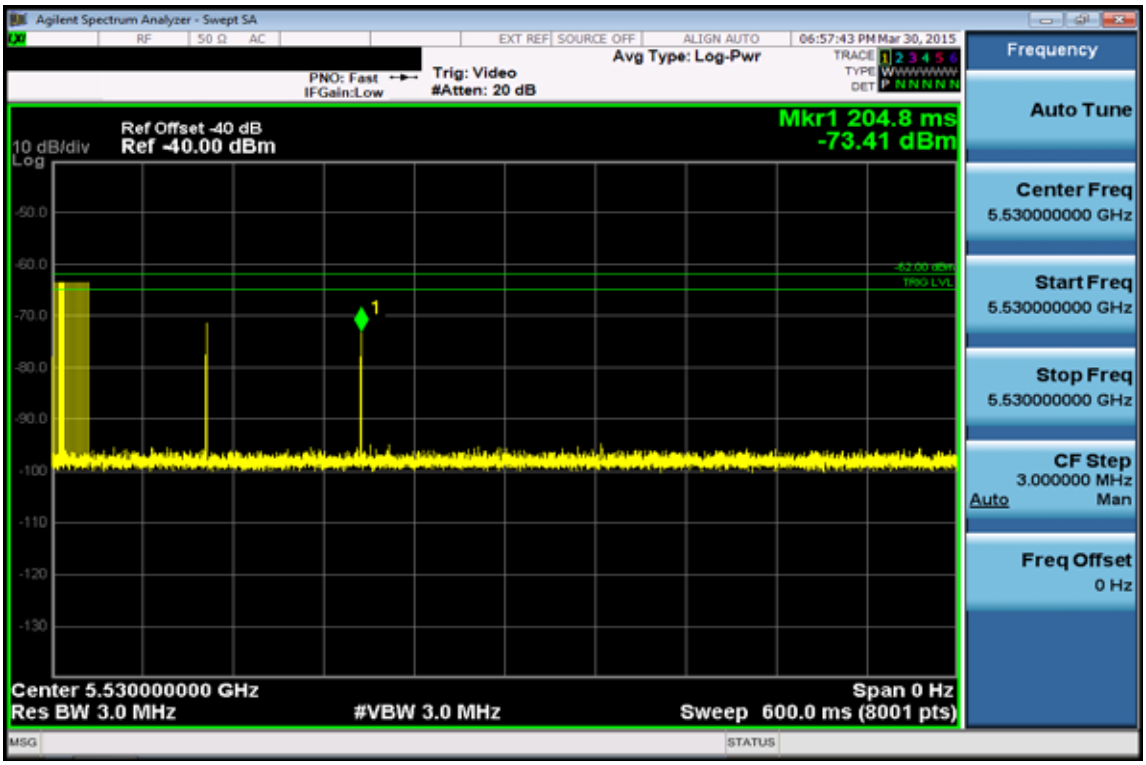
Radar Type 1 Channel Closing Transmission Time - 4



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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