



FCC/IC Test Report

FOR

Intel Corporation

Model Name: EP110

Product Description: Intel 4.7-inch Smartphone with GSM, GPRS, EDGE, UMTS, HSPA+, LTE, WLAN, BT and GPS radios

FCC ID: O2Z-EP110
IC ID: 1000W – EP110

47 CFR Part 15
CHANNEL_PLAN_COMPLIANCE

TEST REPORT #: EMC_INTEL-054-14001_CHANNEL_PLAN_COMPLIANCE_REV1

DATE: 2014-11-13



FCC :
Accredited

IC recognized #
3462B-1

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1 Assessment

The document 'EP110 Operational Description' which will be filed under exhibit type 'Operational Description' contains the detail channel plan for the frequency range under investigation (2.4GHz/5GHz DTS and 5GHz UNII) as well as details about the implementation to meet the requirements and definitions regarding master and slave mode, related channel use permissions etc. as stipulated in FCC part 15.202, 15.247 and 15 E, and in associate FCC guidance provided through valid versions of KDBs 848637 and 594280.

The following equipment (and as identified in Ch.3 of this test report) has been verified to behave according to the Operational Description and meet the requirements of the above standards. No deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Intel Corporation	Intel 4.7-inch Smartphone with GSM,GPRS,EDGE,UMTS,HSPA+,LTE, WLAN, BT and GPS radios	EP110

Responsible for Testing Laboratory:

2014-11-13	Compliance	Franz Engert (Manager Compliance)	
Date	Section	Name	Signature

Responsible for the Report:

2014-11-13	Compliance	Jennifer Huang (EMC Technician)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section3.

CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Test Lab Manager:	Franz Engert
Responsible Project Leader:	Saman Rami

2.2 Identification of the Client

Applicant's Name:	Intel Corporation
Street Address:	2200 Mission College MS:SC1-20
City/Zip Code	Santa Clara, CA 94085
Country	USA
Contact Person:	Christine Ryan
Phone No.	+1 (408) 300-2167
e-mail:	Christine.m.ryan@intel.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as client.
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name / Model No:	EP110
HW / SW Revision :	PR2 / 4.4.4 KTU84P main engineering 53181-dev-keys
FCC-ID / IC-ID:	O2Z-EP110
Product Description:	Intel 4.7-inch Smartphone with GSM,GPRS,EDGE,UMTS,HSPA+,LTE, WLAN, BT and GPS radios
Frequency Range:	2400 – 2480 (ISM) – without Channels 12-14 5150 – 5250 (UNII-1) 5250 – 5350 (UNII-2A) 5470 – 5725 (UNII-2C) without Channels 118-128 and 138-144 5.725– 5825 (UNII-3)
Modes of Operation	ISM Client with Active Scan, Hotspot, AD-HOC UNII-1 Client with passive scan UNII-2A/2C Client with passive scan UNII-3 Client with Active Scan, Hotspot, AD-HOC DFS client only TCP is not supported 1 transmit and 1 receive chain (no MIMO technology support) The detail channel plan is given in the manufacturer's Operational Description which is part of the exhibits for the FCC/IC filings.
Data rates used:	802.11b: 1 Mbps ; 802.11a/g: 6 Mbps ; 802.11n: 6.5 Mbps; 802.11 ac
power supply	AA lithium battery pack (dedicated) Voltage Range 3.6V-4.2V DC Nominal Voltage 3.8V DC
operating temperature range	-10°C to +55°C
Prototype / Production unit	Prototype

3.2 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	Sample	HW/FW Version	Notes
1	INV141400717	Radiated/Conducted	PR2/ 4.4.4 KTU84P main engineering 53181-dev- keys	The DUT was tested with “off the shelf” SW configuration including the Android operating system SW version 4.4.4 IFWI version 0002.00B4 and Kernel version 3.10.20-x86_64_moor-264270-g92fa09c.

4 Test Setup

4.1 Configuration

R&S CMU200 to establish a GSM connection to update MCC, MNC

R&S CMW500 to establish a Wi-Fi link with the DUT

R&S FSU spectrum analyzer to ensure the EUT is not transmitting if not allowed and measure power densities to ensure that the correct power tables are used.

The DUT is connected to the Wi-Fi radio, spectrum analyzer and to the cellular radio via cable through a 1x3 divider and a 1x2 divider is used to connect to the 50Ohm connector for cellular radio and the 50Ohm connector for WiFi radio.



4.2 Environmental conditions during Test:

The following environmental conditions were maintained during the course of testing:

Ambient Temperature: 20-25°C

Relative humidity: 40-60%

4.3 Dates of Testing:

9/25/2014 – 9/27/2014

5 Measurements

5.1 Test 1

5.1.1 Function/mode under test:

The DUT is used as Wi-Fi client in default mode (without geo-location known).

It is tested whether it will attach to an AP on one of the channels that are not part of the default channel plan as described in “EP110 Operational Description”. This is necessary as the device may be used in default mode in the US if not connected to a cellular network.

5.1.2 Procedure:

Set Wi-Fi channel on CMW to 12. Set DUT into airplane mode to ensure that it will not retrieve MCC/MNC. Power cycle the DUT to set it into default mode. Turn on Wi-Fi client mode and leave DUT in airplane mode. Wait for 2 minutes if DUT will find the SSID of CMW. If yes select “connect” option. Monitor on spectrum analyzer for power emitted from DUT on ch12. Repeat for channel 14, 52 and 140. Verify test setup by attempting a connection on ch11.

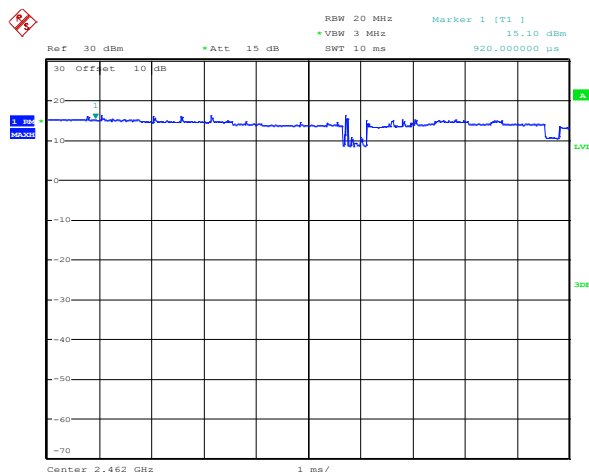
5.1.3 Pass criterion:

The DUT shall not connect to channel 12-14 and 120-128 and on channel 140. A connection on ch11,52,140 must be successful.

5.1.4 Result:

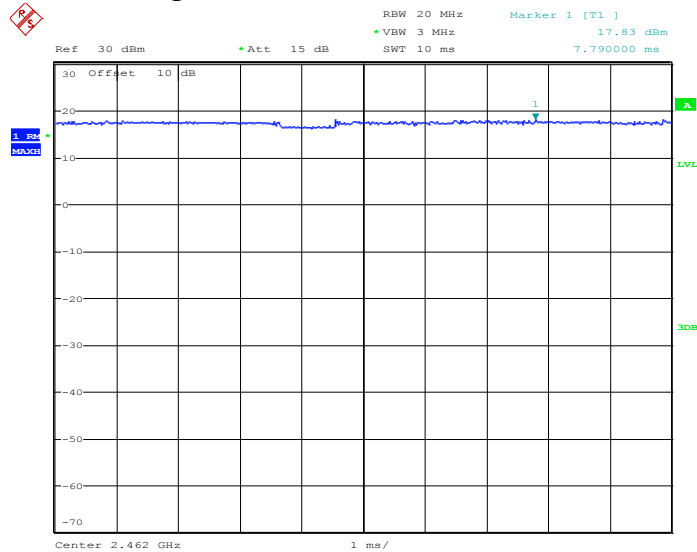
PASS. No connection possible to channel 12-14, 144 no connection possible to channel 144. On ch11,Ch52,Ch140 connection is successful. Beacon visible on Spectrum Analyzer Trace but no signal from EUT as seen for Ch11. As the active scan is running with higher RMS than the actual traffic the active scan traces below have been compared.

5.1.4.1 Traffic on Ch11



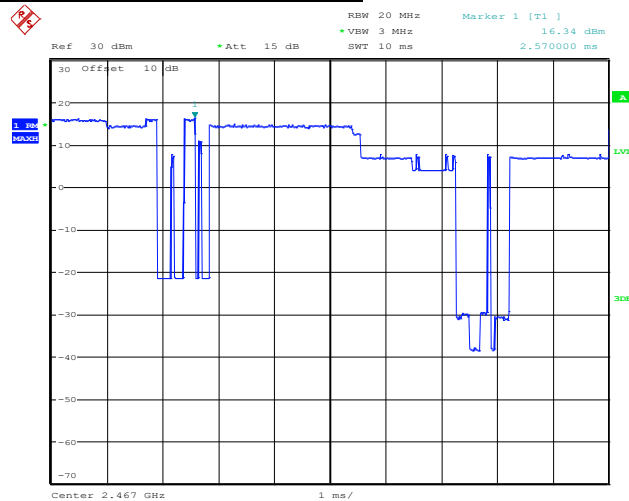
Date: 26.SEP.2014 10:00:51

5.1.4.2 Active Scan on Ch11 with higher RMS than traffic



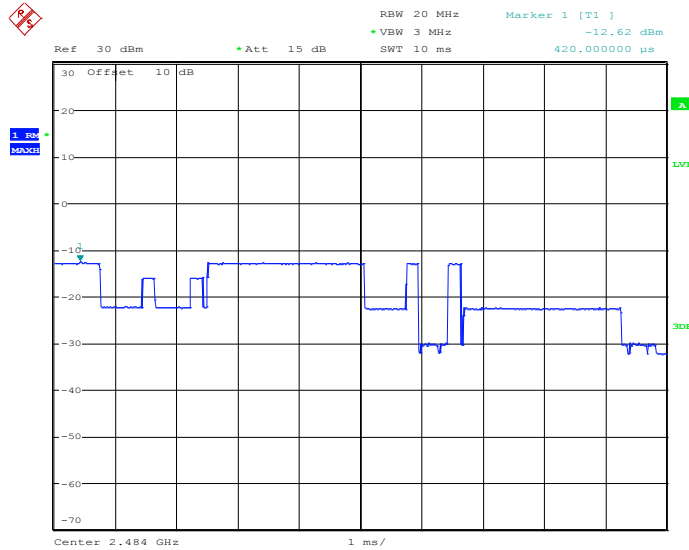
Date: 26.SEP.2014 10:02:19

5.1.4.3 Attenuated active scan from Ch11 on Ch12



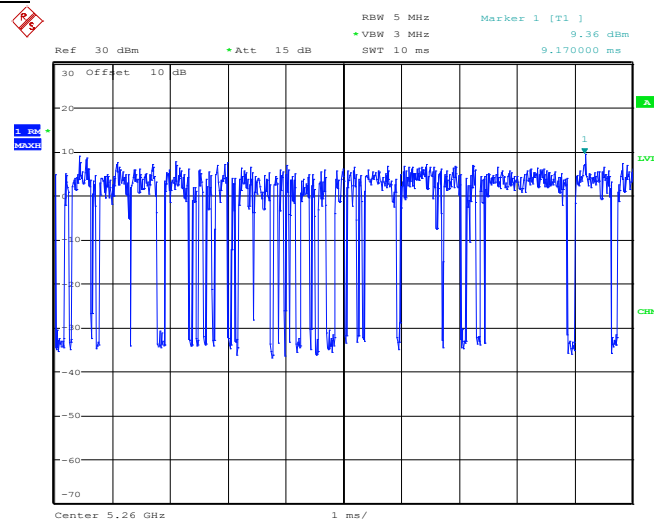
Date: 26.SEP.2014 09:56:05

5.1.4.4 Attenuated active scan from Ch11 on Ch14



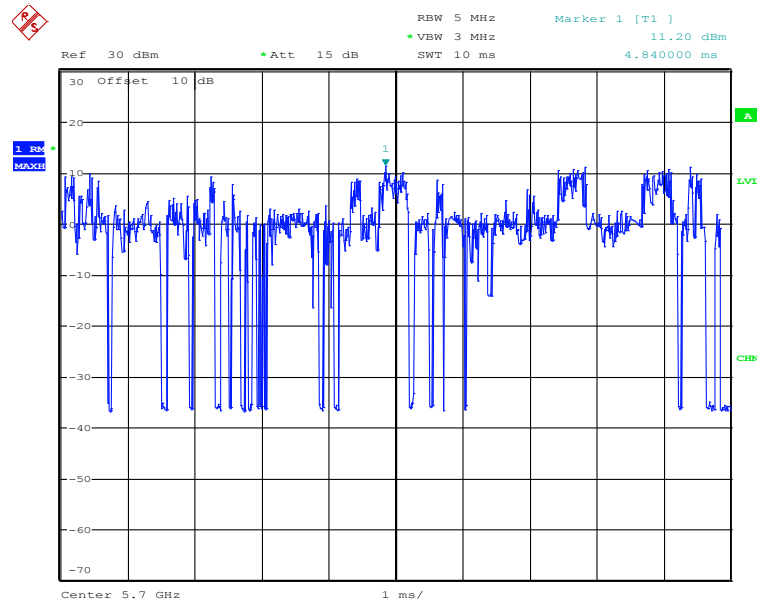
Date: 26.SEP.2014 09:58:05

5.1.4.5 Traffic on Ch52



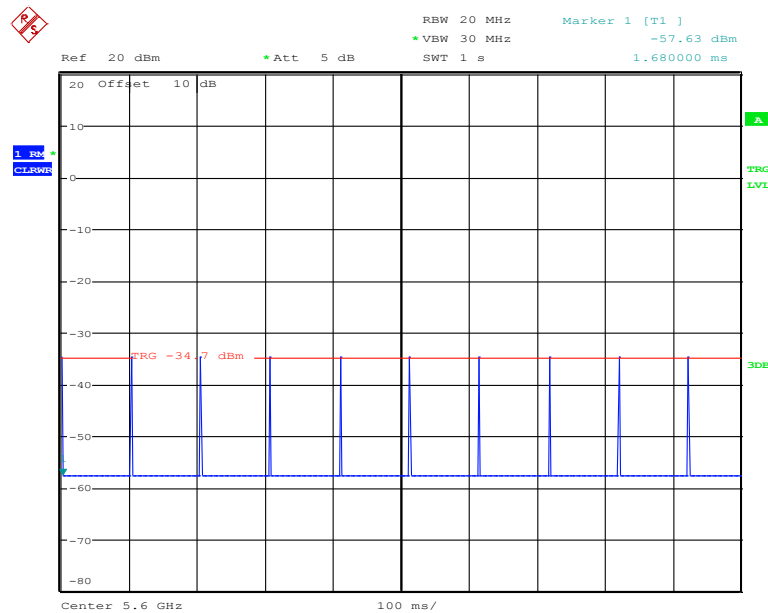
Date: 26.SEP.2014 09:48:14

5.1.4.6 Traffic on Ch140



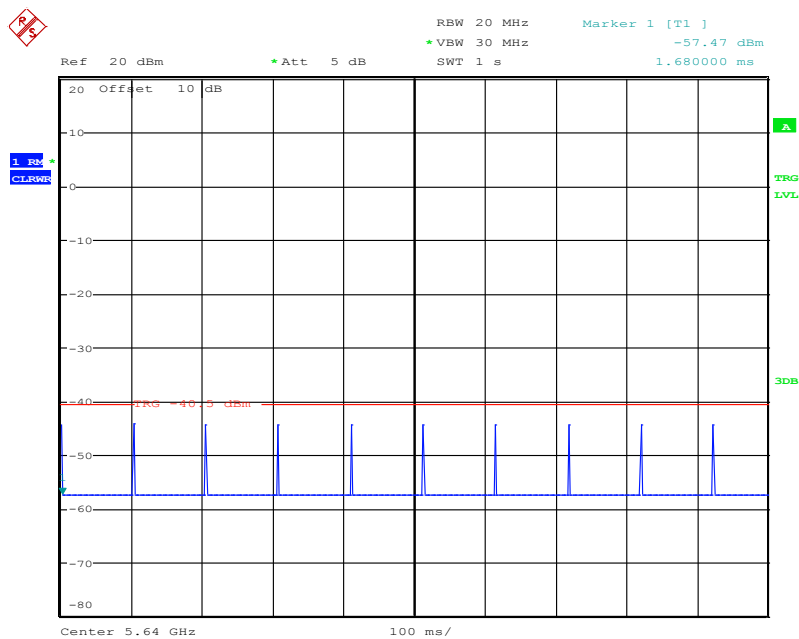
Date: 26.SEP.2014 09:51:56

5.1.4.7 Only beacons on Channel 120



Date: 27.SEP.2014 09:08:39

5.1.4.8 Only beacons on Ch128



Date: 27.SEP.2014 09:09:37

5.2 Test 2

5.2.1 Function/mode under test:

The DUT is configured as Wi-Fi client in USA mode.

It is tested whether it will attach to an AP on one of the channels that are not part of the USA channel plan as described in “EP110 Operational Description”.

5.2.2 Procedure:

Set Wi-Fi channel on CMW to 11. Set CMU to MCC310 MNC 030 to simulate USA. Attach DUT to CMU via GSM. Turn on Wi-Fi client mode and associate DUT to ch11. Change Wi-Fi channel to 12, 13 14, 120, 124, 128, 144.

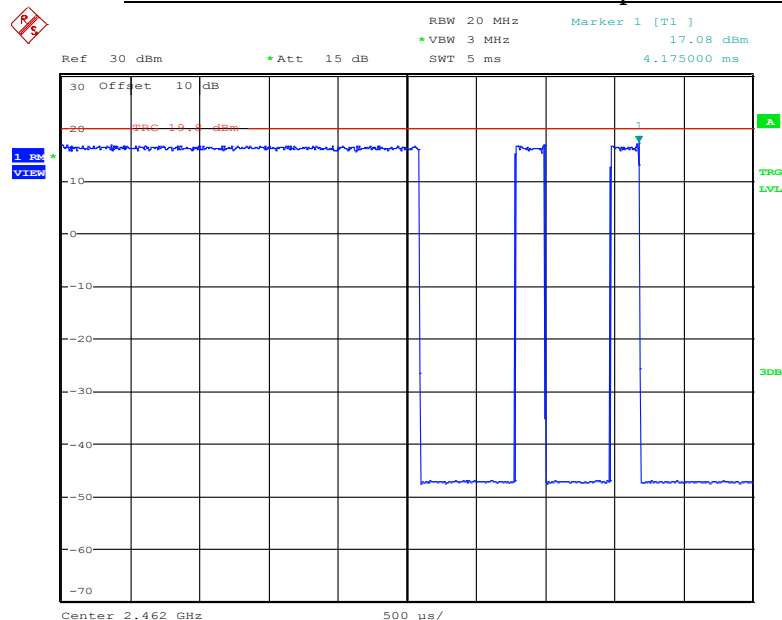
5.2.3 Pass criterion:

The DUT shall not connect to channel 12, 13 14, 120, 124, 128, 144. On Ch11 and 116 connection shall be successful.

5.2.4 Result:

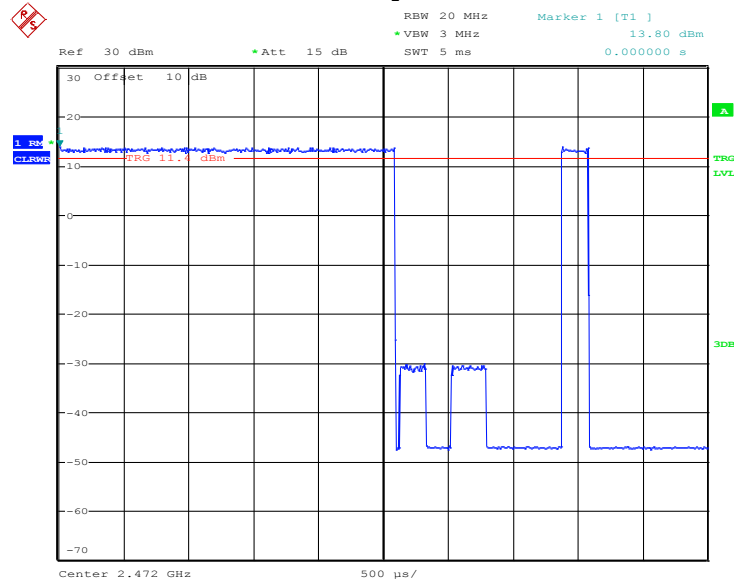
PASS.

5.2.4.1 Active Scan on Ch11 with more RMS power than traffic



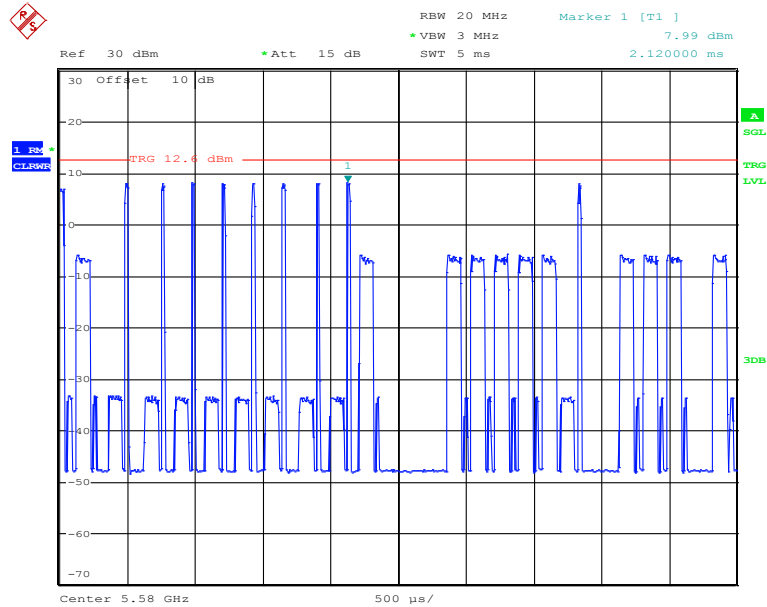
Date: 26.SEP.2014 10:22:08

5.2.4.2 Attenuated Active scan from Ch11 on Ch13 plus Beacon from Ch13 – no traffic



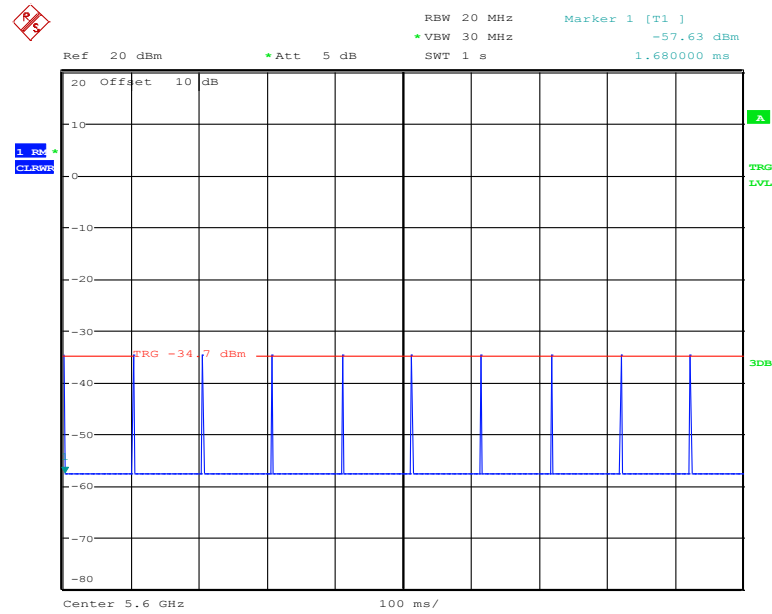
Date: 26.SEP.2014 10:17:26

5.2.4.3 Traffic on Channel 116



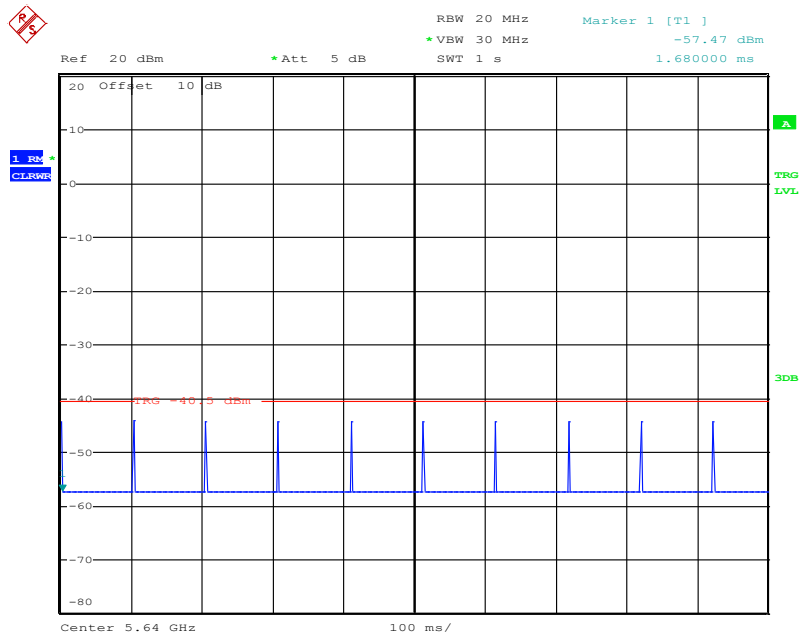
Date: 26.SEP.2014 13:56:44

5.2.4.4 Only beacons on Channel 120



Date: 27.SEP.2014 09:08:39

5.2.4.5 Only beacons on Ch128



Date: 27.SEP.2014 09:09:37

5.3 Test 3

5.3.1 Function/mode under test:

The DUT is configured as Wi-Fi AP in default mode (without geo-location known). It is tested whether it transmits any beacons on one of the channels that are not part of the default channel plan as described in “EP110 Operational Description”.

5.3.2 Procedure:

Disconnect CMW. Set DUT into airplane mode to ensure that it will not retrieve MCC/MNC. Power cycle the DUT to set it into default mode. Turn on Wi-Fi hot-spot mode and leave DUT in airplane mode. Check with the spectrum analyzer whether DUT transmits any beacons on the selected channel. Attempt to set the hot-spot to any channel not supported in default mode according to “DZ110 Operational Description”. Verify the test setup by setting up a hotspot on channel 11 with a Wi-Fi monitoring tool.

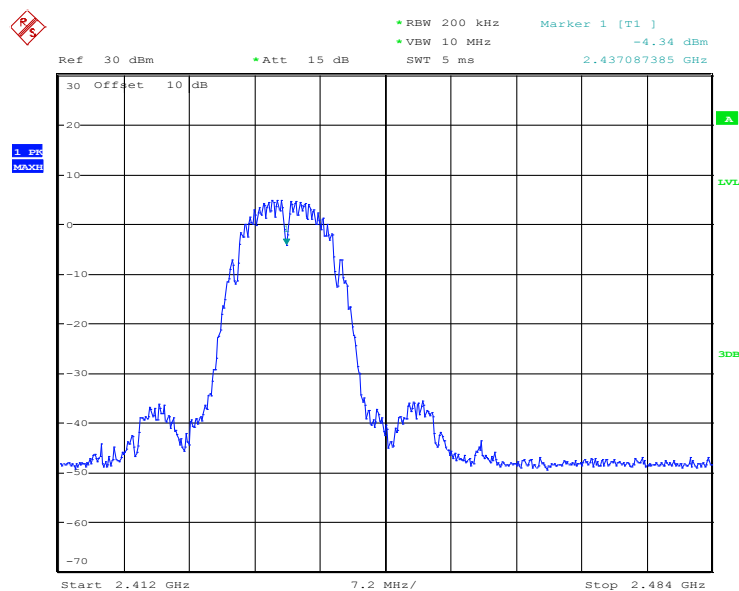
5.3.3 Pass criterion:

It shall not be possible to set the DUT into hot-spot mode on channel 12-14 and channel 52-140. Setting up a hotspot on channel 6 must work.

5.3.4 Result:

PASS. Configuration of hot spot on channel 12-14 and on any 5GHz channel was not possible via SW-menu (not available in selection list). Setting up hotspot on channel 6 was successful.

5.3.4.1 Hotspot on channel 6



5.4 Test 4

5.4.1 Function under test:

Wi-Fi station in default mode. It is tested that the DUT in default mode (without geo-location known) will not transmit as a client using active scan.

5.4.2 Procedure:

Disconnect CMW. Set DUT into airplane mode to ensure that it will not retrieve MCC/MNC. Power cycle the DUT to set it into default mode. Turn on Wi-Fi-client mode and leave DUT in airplane mode. Check with the spectrum scanning 2.4GHz to 2.483GHz range on peak hold whether any signal from DUT can be received. Switch the Wi-Fi client mode on and off 5 times. Repeat this procedure while monitoring the 5.15 to 5.825 GHz range.

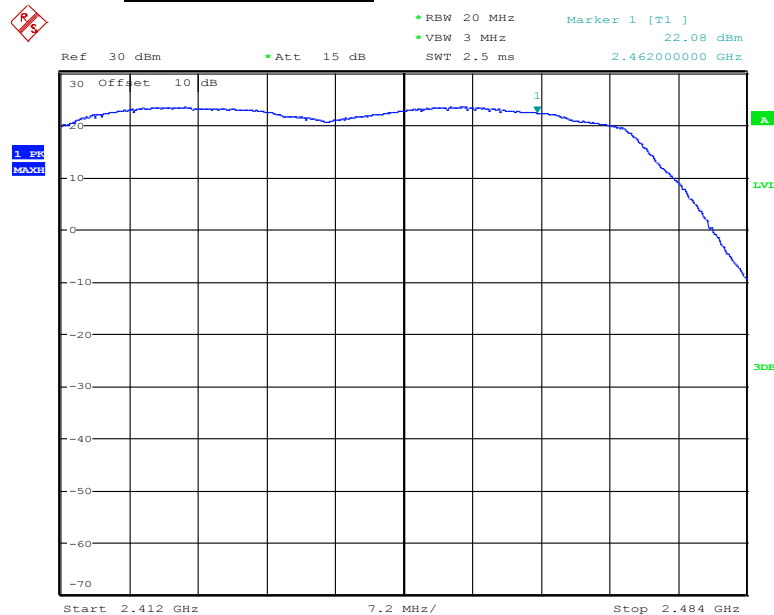
5.4.3 Pass criterion:

No signal detected on the spectrum analyzer above Channel 11 2.46GHz and outside the ranges 5.18GHz to 5.35GHz and 5.735GHz to 5.825GHz.

5.4.4 Result:

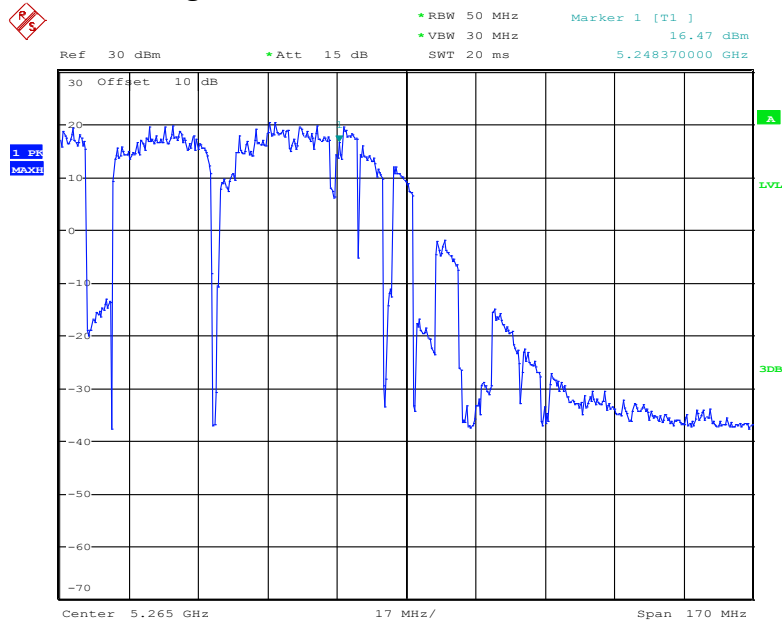
PASS. See traces below.

5.4.4.1 active scan 2.4GHz



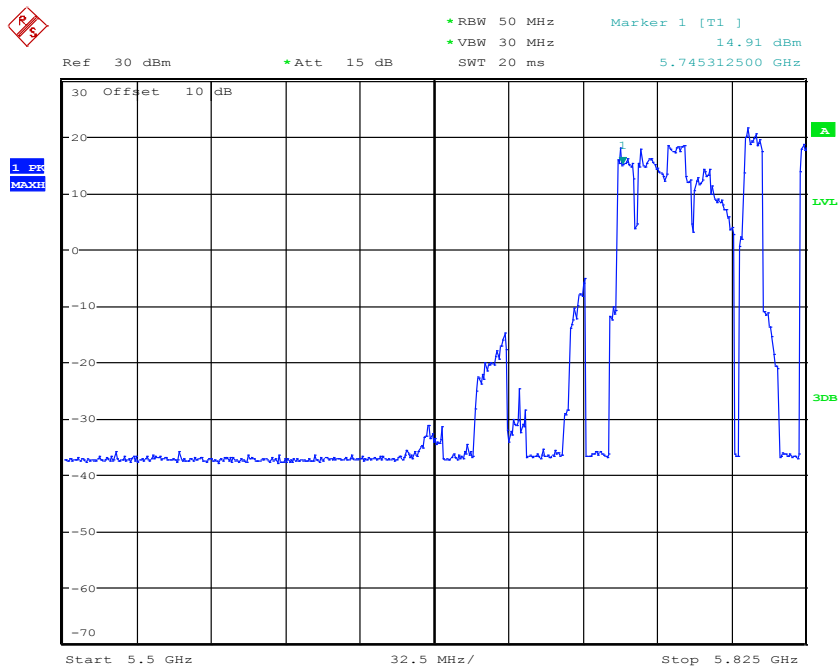
Date: 26.SEP.2014 14:22:01

5.4.4.2 active scan 5GHz lower region



Date: 27.SEP.2014 07:38:40

5.4.4.3 active scan 5GHz higher region



Date: 27.SEP.2014 07:53:15

5.5 Test 5

5.5.1 Function under test:

It is tested whether removing the SIM card sets the DUT into default mode.

5.5.2 Procedure:

The CMU is configured to MCC 262 MNC 01 to simulate a location in Germany. Attach the DUT to the CMU via GSM. Set the CMW to channel 13 and associate the DUT. Terminate the Wi-Fi connection and remove the SIM card without power cycling the DUT. Wait for 2 minutes for DUT to re-associate to channel 13. Verify the setup by then attempting to re-associate to channel 11.

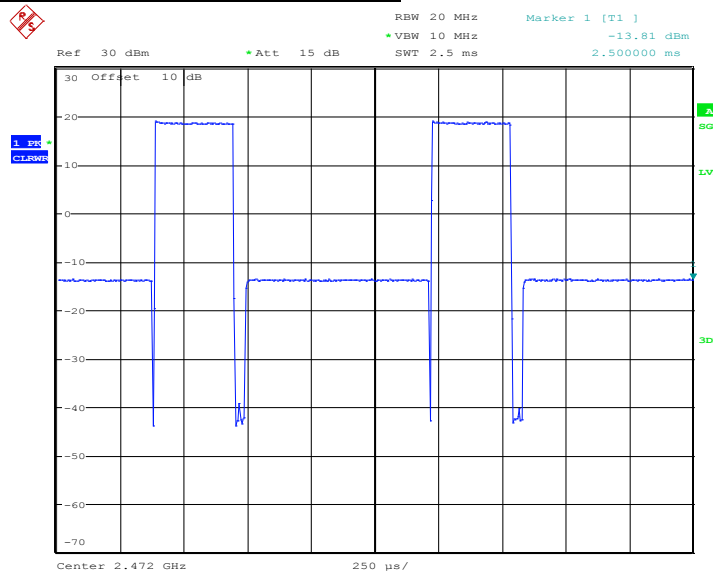
5.5.3 Pass criterion:

Connection to channel 13 shall be possible with German geo-location. Connection to channel 13 shall not be possible after removing SIM card. Connection to channel 11 shall be possible after removing SIM card.

5.5.4 Result:

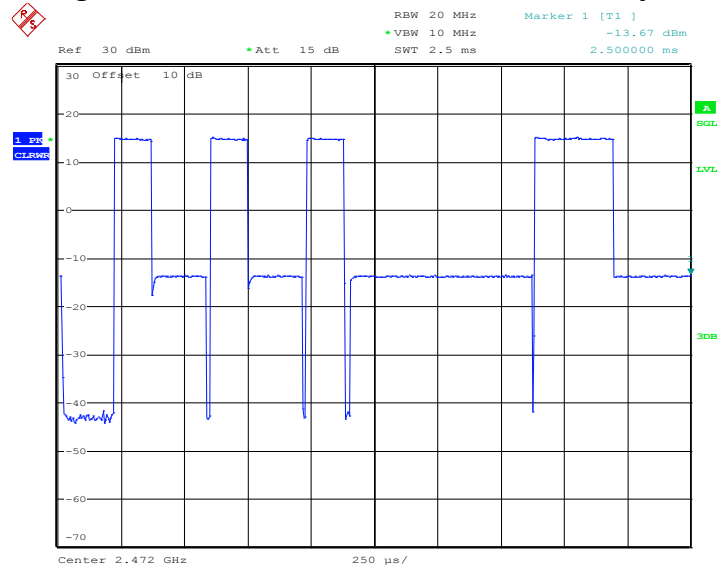
PASS.

5.5.4.1 Traffic on Ch13 with German MCC MNC



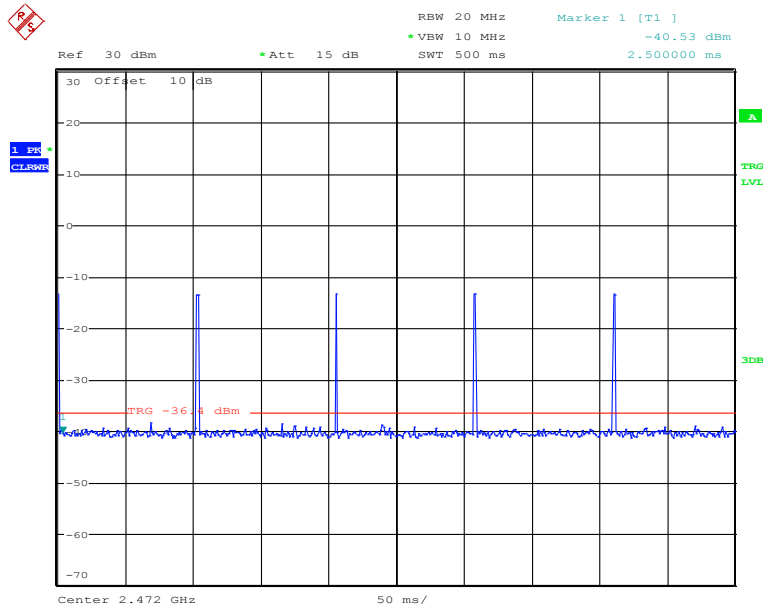
Date: 27.SEP.2014 08:23:46

5.5.4.2 Traffic after attaching to US MCC MNC - WiFi was continuously in traffic



Date: 27.SEP.2014 08:28:52

5.5.4.3 Only beacons on Ch13 when attached to US MCC MNC after resetting WiFi connection



Date: 27.SEP.2014 08:31:07

5.6 Test 6

5.6.1 Function under test:

Wi-Fi station in default mode. It is tested that the DUT in default mode (without geo-location known) and USA mode (with geo-location known) will not transmit with power densities higher than FCC regulative Power. This is required as the powers densities in the 15.247 and 15.407 reports have been measured by stimulating the TX with a tool that is not subject of the control of the mechanisms of the DUT SW.

5.6.2 Procedure:

Set Wi-Fi channel on CMW to 1. Set DUT into airplane mode to ensure that it will not retrieve MCC/MNC. Power cycle the DUT to set it into default mode. Turn on Wi-Fi client mode and leave DUT in airplane mode. Wait for 2 minutes if DUT will associate to CMW. Measure the power densities on channel 1 with spectrum analyzer. Attach the DUT to the CMU with MCC310 MNC 030 to simulate USA. Turn off airplane mode. Reconnect the Wi-Fi to channel 1 and measure the power densities on channel 1 with spectrum analyzer. Repeat the whole procedure for channel 11, 36, 52, 100, 149.

5.6.3 Pass criterion:

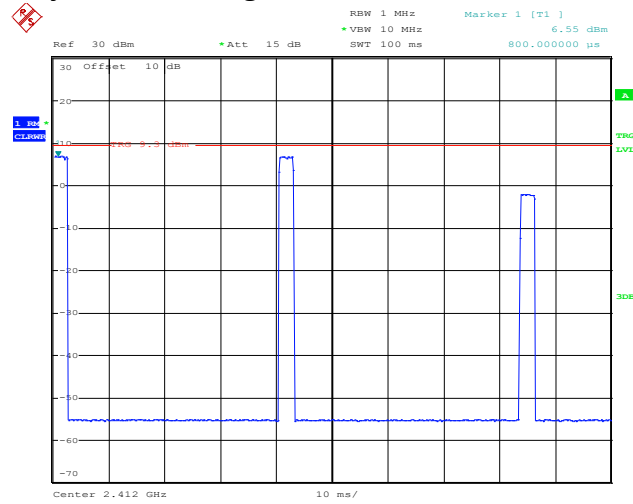
The DUT will use no more than the below power densities.

FCC	☒ Part 15 Subpart C, §15.407(a)(1)(2)(5)
Limits [dBm/MHz]	ISM: $\leq 8\text{dBm}$ in any 3kHz band U-NII 1: $\leq 11\text{dBm}$ in any 1 MHz band U-NII 2+ext.: $\leq 11\text{dBm}$ in any 1 MHz band U-NII 3: $\leq 30\text{dBm}$ in any 500kHz band

5.6.4 Result:

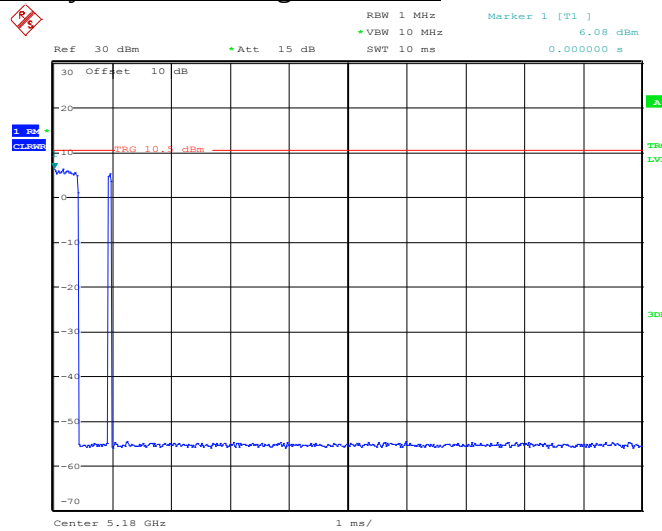
PASS.

5.6.4.1 Max Power Density on Ch1 during active scan



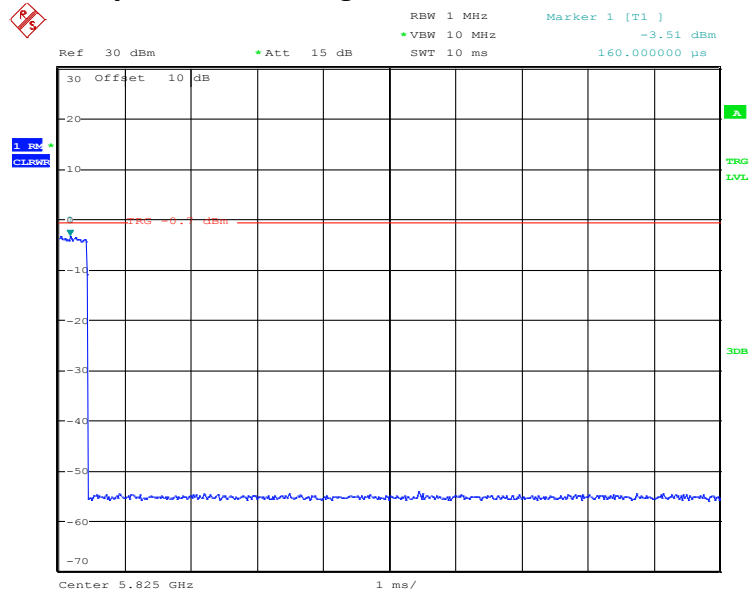
Date: 27.SEP.2014 08:40:59

5.6.4.2 Max Power Density on Ch36 during active scan



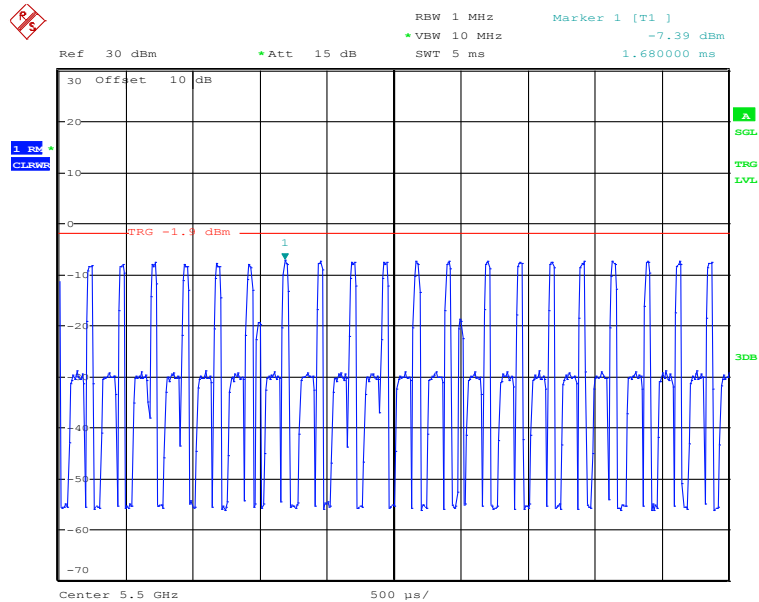
Date: 27.SEP.2014 08:45:43

5.6.4.3 Max Power Density on Ch165 during active scan



Date: 27.SEP.2014 08:51:44

5.6.4.4 Max Power Density on Ch100 in traffic



Date: 27.SEP.2014 08:55:50

5.7 Test 7

5.7.1 Function under test:

Wi-Fi station in default mode. It is tested whether the Country code setting of the Wi-Fi network can overrule the specified way of selecting allowed channel via MCC, MNC by changing country code on the CMW to Germany (DE) and checking if channel 12 and 13 will become available.

5.7.2 Procedure

Set Wi-Fi channel on CMW to 12. Set DUT into airplane mode to ensure that it will not retrieve MCC/MNC. Power cycle the DUT to set it into default mode. Turn on Wi-Fi client mode and leave DUT in airplane mode. Wait for 2 minutes if DUT will associate to CMW. Set the country code on CMW to “DE”. Wait for 2 minutes if DUT will associate to CMW. Verify test setup by setting CMW to ch11.

5.7.3 Pass criterion:

No association possible until channel is set to 11.

5.7.4 Result:

PASS.

6 Test Equipment and Ancillaries used for tests

Item Name	Manufacturer	Equipment Type	Model	Serial #	Calibration Cycle	Last Calibration Date
Binconlog Antenna 3141	EMCO	Binconilog Antenna	3141	0005-1186	3 years	4/5/2012
Digital Radio Comm. Tester CMU 200# 4	R&S	Digital Radio Comm. Tester	CMU 200# 4	110229	2 Years	6/15/2013
Digital Radio Comm. Tester CMU 200 #1	R&S	Digital Radio Comm. Tester	CMU 200 #1	101821	2 Years	6/17/2013
Digital Radio Comm. Tester CMU 200 #2	R&S	Digital Radio Comm. Tester	CMU 200 #2	109879	2 Years	6/15/2013
Digital Radio Comm. Tester CMU 200 #3	R&S	Digital Radio Comm. Tester	CMU 200 #3	110759	2 Years	6/15/2013
ESU Receiver	R&S	EMI Receiver	ESU40	100251	2 Years	9/13/2013
Horn Antenna 3115	EMCO	Horn Antenna	3115	35114	3 years	3/6/2012
Horn Antenna 3116	EMCO	Horn Antenna	3116	70497	3 years	3/2/2012
LISN ESH3-Z5	R&S	LISN	ESH3-Z5	836679/003	2 Years	6/18/2013
LISN ESH3-Z6	R&S	LISN	ESH3-Z6	836154/011	2 Years	6/16/2013
LISN FCC-LISN-50-25-2-08	FCC	LISN	FCC-LISN-50-25-2-08	70497	2 Years	7/12/2012
Log Periodic Antenna 3149	ETS Lindgren	Log Periodic Antenna	3149	1186	3 years	8/23/2011
Loop Antenna 6512	ETS Lindgren	Loop Antenna	6512	49838	3 years	8/1/2011
Thermometer Humidity TM320	Dickson	Thermometer Humidity	TM320	5280063	1 Year	4/15/2013
Thermometer Humidity TM325	Dickson	Thermometer Humidity	TM325	5285354	2 Years	4/15/2013
FSU 26	R&S	Spectrum Analyzer	FSU 26	100189	2 Years	6/1/2013
SMP04	R&S	Signal Generator	SMP04	100151	2 Years	6/17/2013

Test Report #: EMC_INTEL-054-14001_CHANNEL_PLAN_COMPLIANCE_Rev1 **FCC ID: O2Z-EP110**

Date of Report : 2014-11-13

IC ID: 1000W – EP110



7 Revision History

Date	Report Name	Changes to report	Report prepared by
2014-9-27	EMC_INTEL-054-14001_CHANNEL_PLAN_COMPLIANCE	First Version	F. Engert
2014-11-13	EMC_INTEL-054-14001_CHANNEL_PLAN_COMPLIANCE_Rev1	Add reference to the relevant KDB and rule parts	F. Engert