DFS TEST REPORT

Test report No.:	EMC- FCC- R0114-1
FCC ID:	2AAKFMWP1100A
Type of equipment:	WiFi Phone
Model Name:	MWP1100A
Applicant:	Moimstone.co.,Ltd
Max.RF Output Power:	14.86 dBm
FCC Rule Part(s):	FCC Part 15 Subpart C 15.407
Frequency Range:	5 180 MHz ~ 5 240 MHz 5 260 MHz ~ 5 320 MHz 5 500 MHz ~ 5 700 MHz
Test result:	Complied

The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.
The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of test: June 24, 2013 ~ July 01, 2013

Issued date: July 02, 2013

Tested by: SON, MIN GI

Approved by: YU, SANG HOON.

480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
82 31 336 9919 (Main) 82 31 336 4767 (Fax)

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480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
82 31 336 9919 (Main) 82 31 336 4767 (Fax)

1. Client information

Applicant:	Moimstone.co.,Ltd
Address:	65, Heungan-daero 439 beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, KOREA
Telephone number:	+82-70-7791-3750
Facsimile number :	+82-31-426-9539
Contact person:	Yoo Deok Jae / nunjoa@moimstone.com

Manufacturer :	Moimstone.co.,Ltd
Address:	65, Heungan-daero 439 beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, KOREA

2. Laboratory information

Address
EMC Compliance Ltd.
480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
Telephone Number: 82 31 336 9919 Facsimile Number: 82 31 336 4767

Certificate
CBTL Testing Laboratory, KOLAS NO.: 231
FCC Filing No.: 508785
VCCI Registration No.: C-1713, R-1606, T-258
IC Recognition No.:8035A-2

SITE MAP

3. Description of E.U.T.

3.1 Basic description

Applicant :	Moimstone.co.,Ltd
Address of Applicant:	65, Heungan-daero 439 beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, KOREA
Manufacturer:	Moimstone.co.,Ltd
Address of Manufacturer:	65, Heungan-daero 439 beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, KOREA
Type of equipment:	WiFi Phone
Basic Model:	MWP1100A
Serial number:	Proto Type

3.2 General description

Communication	802.11a, an HT20
Frequency Range	5 180 ~ 5 240 MHz, 5 260 ~ 5 320 MHz, 5 500 ~ 5 700 MHz
Type of Modulation (Technologies)	64QAM, 16QAM, QPSK, BPSK(OFDM)
Channel capacity	5 180 ~ 5 240 MHz: 4 ch 5 260 ~ 5 320 MHz: 4 ch 5 500 ~ 5 700 MHz: 8 ch
Antenna Gain	5 180 ~ 5 240 MHz: 2.11 dBi 5 260 ~ 5 320 MHz: 2.03 dBi 5 500 ~ 5 700 MHz: 1.78 dBi
Type of Antenna	Inverted F ANTENNA
Power supply	DC 3.7 V
Operating temperature	-20 ~ 50 ℃
Dimension	155 mm x 51 mm x 16 mm (W x D x H)

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3.3 Test frequency

For all teset items, the low, middle and high channels of the modes were tested with above worst case data rate.

5150~5250 (MHz) : 802.11a, an HT20

	CH	Frequency
Low frequency	36	5 180 MHz
Middle frequency	40	5 200 MHz
High frequency	48	5 240 MHz

5250~5350 (MHz) : 802.11a, an HT20

	CH	Frequency
Low frequency	52	5 260 MHz
Middle frequency	56	5 280 MHz
High frequency	64	5 320 MHz

5470~5725 (MHz) : 802.11a, an HT20

	CH	Frequency
Low frequency	100	5 500 MHz
Middle frequency	116	5 580 MHz
High frequency	140	5 700 MHz

3.4 Test Voltage

mode	Voltage
Norminal voltage	DC 3.7V

4. Summary of test results

4.1 Standards & results

Rule Reference	Parameter	Report Section	Test Result
15.407(h)	**Dynamic Freqyency Selection**	**5.1**	**C**

Note: C = complies
NC = Not complies
NT = Not tested
NA = Not Applicable

4.2 Uncertainty

Measurement Item	Combined Standard Uncertainty Uc	Expanded Uncertainty U = KUc (K = 2)
Conducted RF power	± 0.29 dB	± 0.58 dB
Radiated disturbance	30 ㎒ ~ 300 ㎒ : + 2.43 ㏈, - 2.44 ㏈ 300 ㎒~1 000 ㎒ : + 2.49㏈, - 2.50 ㏈ 1 ㎓ ~ 6 ㎓ : + 3.10 ㏈, - 3.10 ㏈ 6 ㎓ ~ 18 ㎓ : + 3.21 ㏈, - 3.27 ㏈	30 ㎒ ~ 300 ㎒ : + 4.86 ㏈, - 4.88 ㏈ 300 ㎒ ~ 1 000 ㎒ + 4.98㏈, - 4.99 ㏈ 1 ㎓ ~ 6 ㎓ : + 6.19 ㏈, - 6.20 ㏈ 6 ㎓ ~ 18 ㎓ : + 6.41 ㏈, - 6.53 ㏈

5. Test results

5.1 DFS(Dynamic Frequency Selection)

5.1.1 Regulation

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 mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. The minimum DFS detection threshold for devices with a maximum e.i.r.p. of 200 mW to 1 W is -64 dBm. For devices that operate with less than 200 mW e.i.r.p. the minimum detection threshold is -62 dBm. The detection threshold is the received power averaged over 1 microsecond referenced to a 0 dBi antenna. The DFS process shall be required to provide a uniform spreading of the loading over all the available channels.

(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 part, is detected within 60 seconds.

(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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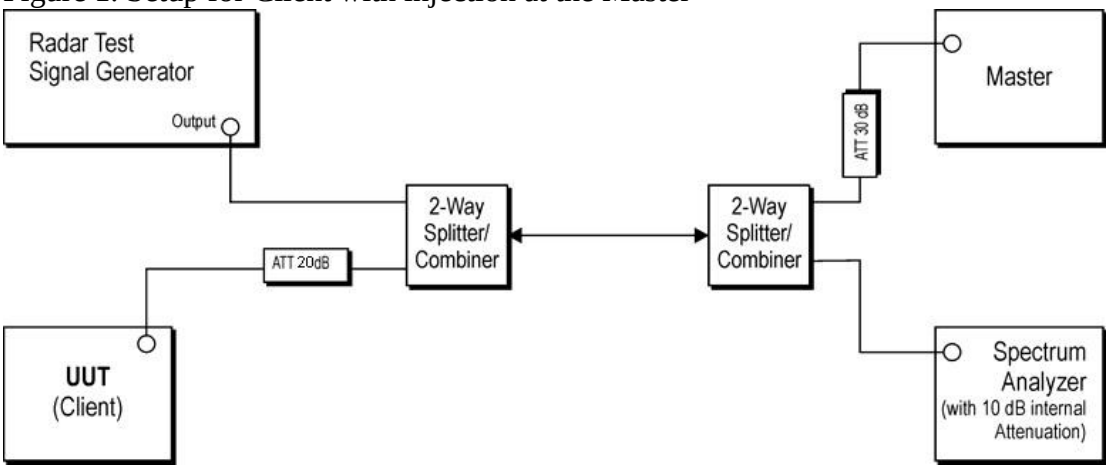
5.1.2 Test Setup

The FCC 06-96 describes a conducted test setup. A conducted test setup was used for this testing. Figure 1 shows the typical test setup. Each one channel selected between 5250 and 5350 MHz, 5470 and 5725 is chosen for the testing.

Figure 1. Setup for Client with injection at the Master



1. The vector signal generator is setup to provide a pulse at the frequency that the Master and Client are operating. A Type 1 radar pulse is used for the testing.

2. The vector signal generator is adjusted to provide the radar burst at a level of approximately -62 dBm at the antenna of the Master device.

3. The Client Device (EUT) is set up per the diagram in Figure 1 and communications between the Master device and the Client is established.

4. The MPEG file specified by the FCC(NTIA approved MPEG2 file) is streamed from the "file computer" through the Master to the Slave Device and played in full motion in order to properly load the network.

5. The spectrum analyzer is set to record about 20 sec window to any transmissions occurring up to and after 10 sec.

6. The system is again setup and the monitoring time is shortened in order to capture the Channel Closing Transmission Time. This time is measured to insure that the Client ceases transmission within 200 ms and the aggregate of emissions occurring after 200 ms up to 10 sec do not exceed 60 ms.

7. After the initial radar burst the channel is monitored for 30 minutes to insure no transmissions or beacons occur. A second monitoring setup is used to verify that the Master and Client have both moved to different channels.

5.1.3 Measurement Procedure

The following table from FCC 06-96 lists the applicable requirements for the DFS testing.
The device evaluated in this report is considered a client device without radar detection capability.

5.1.3.1 Applicability

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
Uniform Spreading	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	Client Without Radar Detection	Client With Radar Detection
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes

5.1.3.2 Requirements

Client Devices

a) A Client Device will not transmit before having received appropriate control signals from a Master Device.
b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.
c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.
d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.

5.1.3.3 DFS Detection Thresholds

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.

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 80% of the U-NII 99% transmission power bandwidth. See Note 3.

Note 1: 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 Waveform.

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 1 is used and for each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

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5.9.2.4 Radar Test Waveforms

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
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

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. For Short Pulse Radar Type 1, the same waveform is used a minimum of 30 times. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms.
The aggregate is the average of the percentage of successful detections of Short Pulse Radar Types 1-4.

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

Each waveform is defined as follows:

1) The transmission period for the Long Pulse Radar test signal is 12 seconds.
2) There are a total of 8 to 20 Bursts in the 12 second period, with the number of Bursts being randomly chosen. This number is Burst_Count.
3) Each Burst consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each Burst within the 12 second sequence may have a different number of pulses.
4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a Burst will have the same pulse width. Pulses in different Bursts may have different pulse widths.
5) Each pulse has a linear frequency modulated chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a Burst will have the same chirp width. Pulses in different Bursts may have different chirp widths. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.
6) If more than one pulse is present in a Burst, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a Burst, the random time interval between the first and second pulses is chosen independently of the random time interval between the second and third pulses.
7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst_Count. Each interval is of length (12,000,000 / Burst_Count) microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and [(12,000,000 / Burst_Count) – (Total Burst Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each Burst is chosen randomly.

A representative example of a Long Pulse Radar Type waveform:

1) The total test waveform length is 12 seconds.
2) Eight (8) Bursts are randomly generated for the Burst_Count.
3) Burst 1 has 2 randomly generated pulses.
4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.
5) The PRI is randomly selected to be at 1213 microseconds.
6) Bursts 2 through 8 are generated using steps 3 – 5.
7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. Bursts 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. Burst 2 falls in the 1,500,001 – 3,000,000 microsecond range).

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

For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

5.1.3 Support Equipment

Product	Manufacture	Model No.	Serial No.	FCCID.
Cisco Aironet IOS Access Point	Cisco	AIR-AP1252AG-K-K9	FGL1439ZOHS	LDK102056

Note. This device was functioned as a Master device during the DFS test.

5.1.4 Test Result

-Complied

The UUT is a U-NII Device operating in Client mode without radar detection. The radar test signals are injected into the Master Device.

The highest power level within these bands in 21.47 dBm(140.29 mW) EIRP in the 5250 ~ 5350 MHz band and 21.68dBm(147.19 mW) EIRP in the 5470 ~ 5725 MHz band.

The gain antenna assembly utilized with the master has a gain of 3.5 dBi.

The calibrated conducted DFS detection threshold level is set to -57.5 dBm.(-62 + 1 + 3.5 = -57.5)

802.11a 5 250 ~5 350 MHz
Channel Move Time

Frequency (MHz)	Channel Move Time	Limit
5 280	< 10 s	10 s

Channel Closing Time

Frequency (MHz)	Channel Closing Time	Limit
5 280	0 ms	60 ms

Non occupancy period

Frequency (MHz)	Non occupancy period	Limit
5 280	> 1800 s	1800 s

802.11a 5 470 ~5 725 MHz

Channel Move Time

Frequency (MHz)	Channel Move Time	Limit
5 520	< 10 s	10 s

Channel Closing Time

Frequency (MHz)	Channel Closing Time	Limit
5 520	0 ms	60 ms

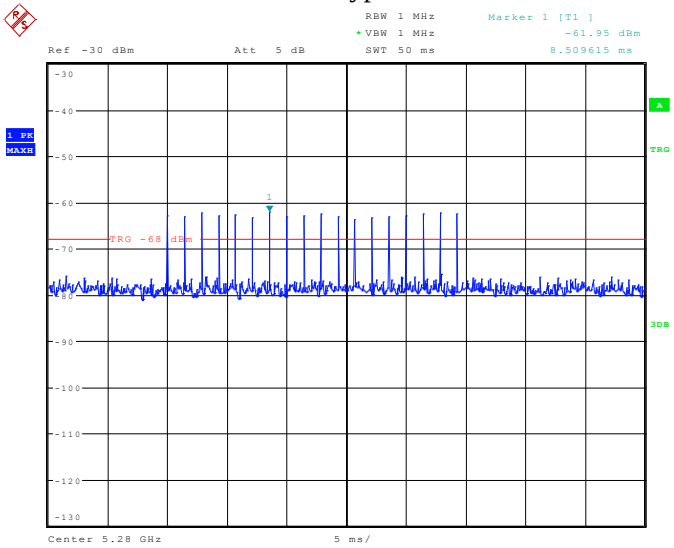
Non occupancy period

Frequency (MHz)	Non occupancy period	Limit
5 520	> 1800 s	1800 s

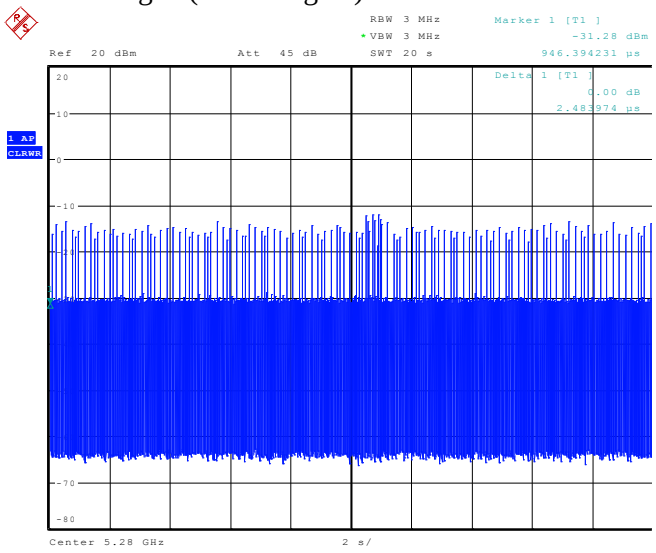
5.1.5 Test Plot

802.11a (5 470 MHz ~ 5 725 MHz)

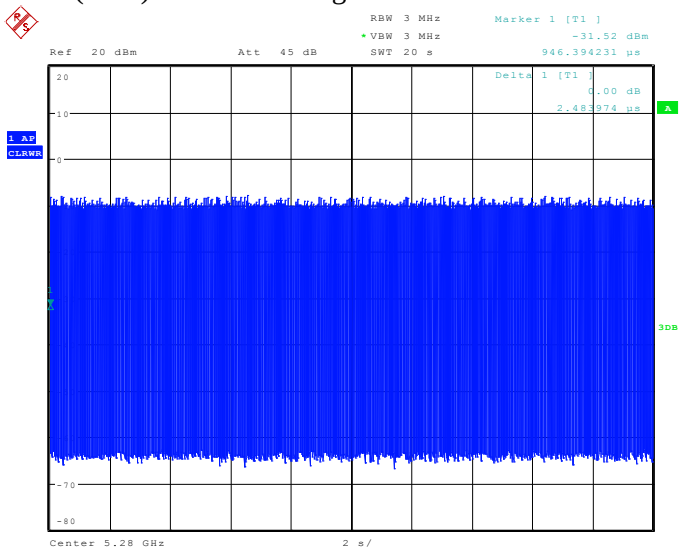
Plot of Radar waveform type1



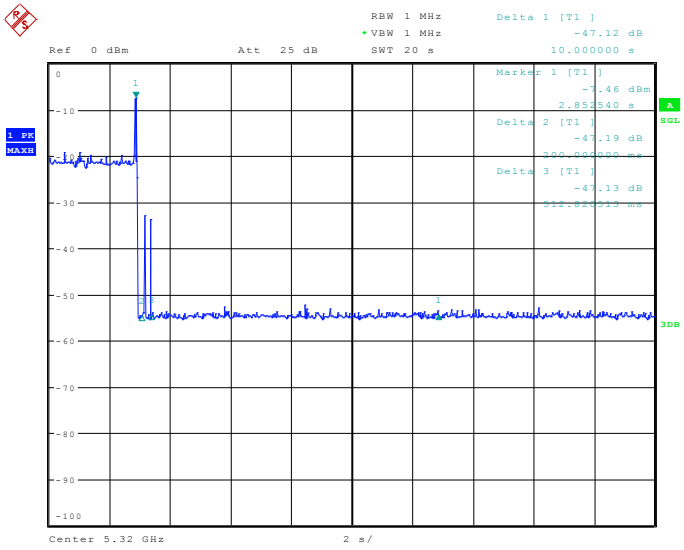
no traffic signal(master signal)



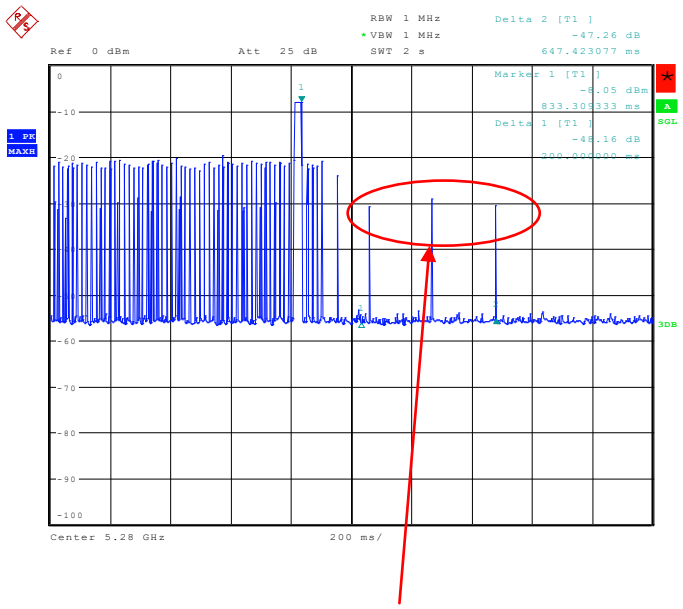
Client(EUT) Data Traffic Signal



Channel move time

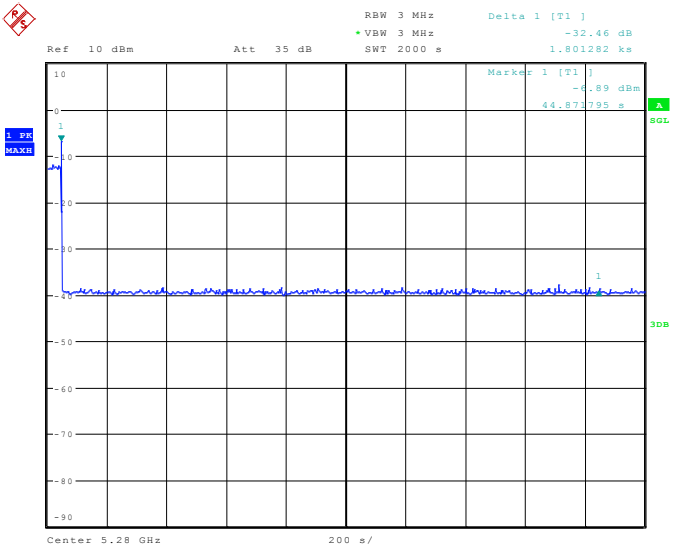


channel closing transmission time



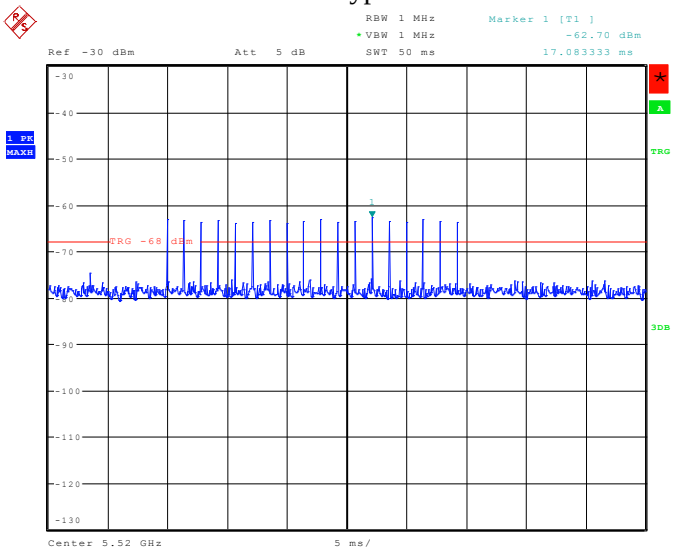
Master Signal

Non occupancy period

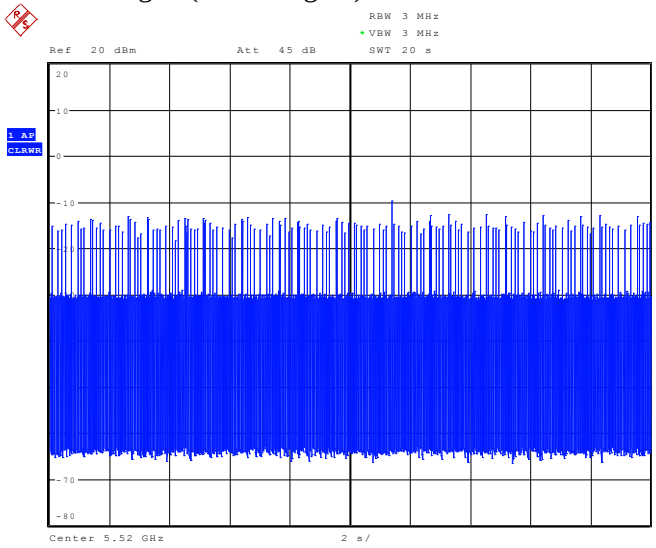


802.11a (5 470 MHz ~ 5 725 MHz)

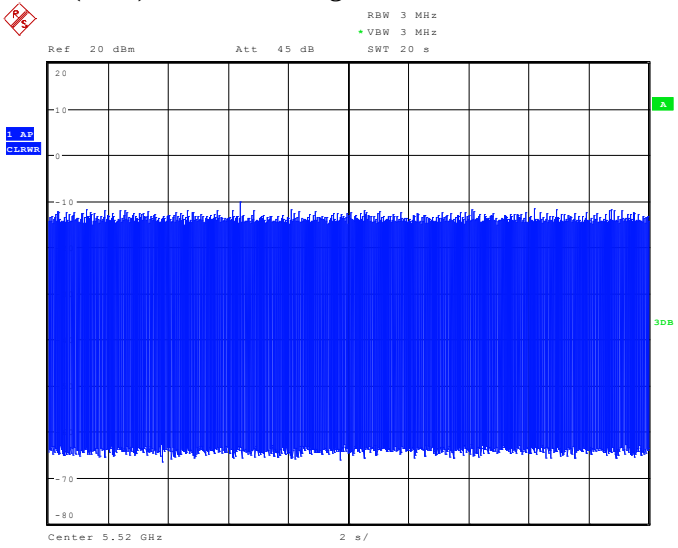
Plot of Radar waveform type1



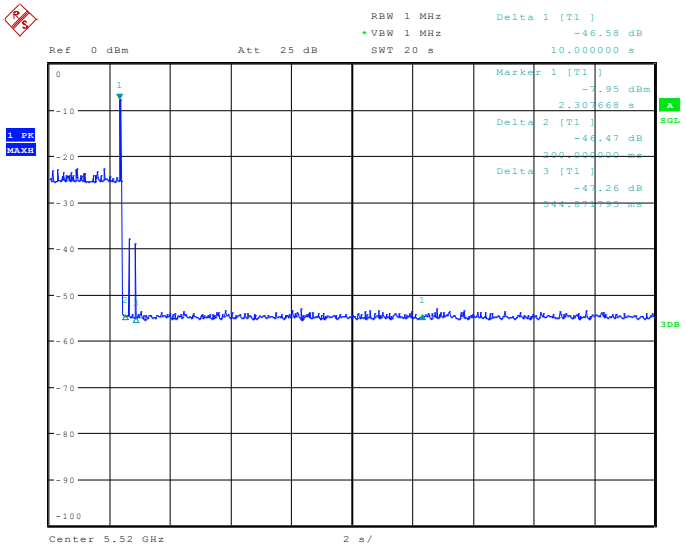
no traffic signal(master signal)



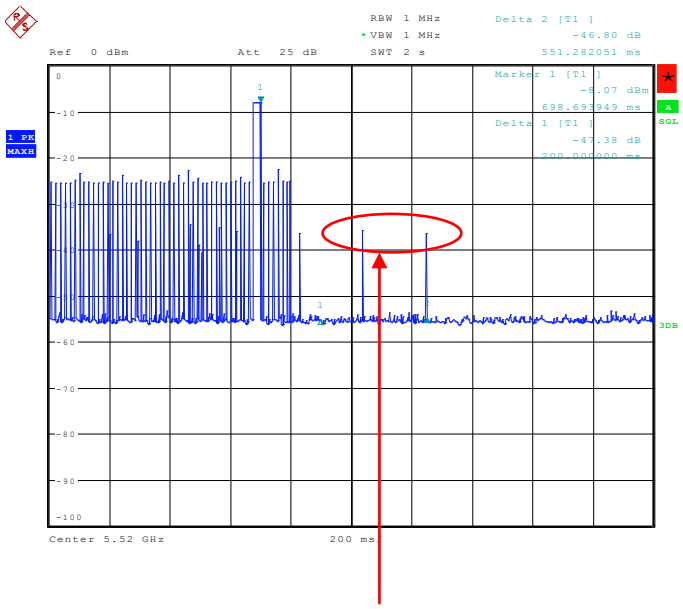
Client(EUT) Data Traffic Signal



Channel move time

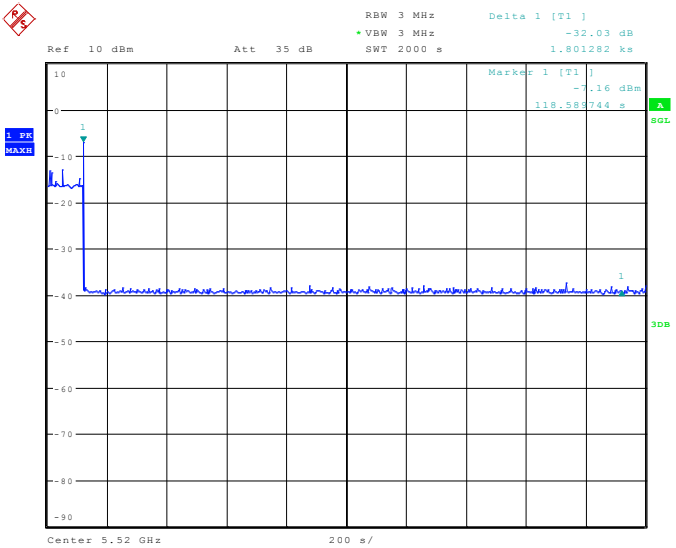


channel closing transmission time



Master Signal

Non occupancy period



6. Test equipment used for test

	Description	Manufacture	Model No.	Serial No.	Next Cal Date.
□	Temp & humidity chamber	Taekwang	TK-04	TK001	13.12.07
□	Temp & humidity chamber	Taekwang	TK-500	TK002	13.09.03
□	Frequency Counter	HP	53150A	US39250565	13.09.04
□	Spectrum Analyzer	Agilent	E4440A	MY46186407	14.06.27
■	Spectrum Analyzer	R & S	FSG13	100051	13.10.23
□	Signal Generator	R & S	SMR40	100007	14.06.27
■	Vector Signal Generator	R & S	SMBV100A	257566	14.01.07
□	Wideband Power Sensor	R & S	NRP-Z81	100677	14.05.06
□	Modulation Analyzer	HP	8901B	3538A05527	13.10.25
□	Audio Analyzer	HP	8903B	3729A19213	13.10.23
□	AC Power Supply	Kikusui	PCR2000W	GB001619	13.10.23
■	DC Power Supply	Tektronix	PS2520G	TW50517	14.03.12
□	DC Power Supply	Tektronix	PS2521G	TW53135	13.10.23
■	Attenuator	HP	8494A	2631A09825	13.10.24
■	Attenuator	HP	8496A	3308A16640	13.10.24
■	Attenuator	BIRD	50-A-MFN-20	0403002	13.10.24
■	Power Divider	Weinschel	1580-1	NX375	13.10.23
■	Power Divider	Weinschel	1580-1	NX380	13.09.09
□	Power Divider	Weinschel	1594	671	13.09.10
□	Power Divider	Krytar	7005265	143244	13.09.03
□	EMI Test Receiver	R&S	ESCI	100710	13.11.06
□	LOOP Antenna	EMCO	EMCO6502	9205-2745	14.05.23
□	BILOG Antenna	Schwarzbeck	VULB 9168	9168-440	13.09.21
□	HORN Antenna	ETS	3115	00086706	13.11.21
□	HORN Antenna	ETS	3116	00086632	13.11.15
□	Amplifier	Sonoma	310N	293004	13.11.06
□	Amplifier	Agilent	8449B	3008A01802	14.05.06
□	Attenuator	HP	8491A	27444	13.11.06
□	Antenna Mast	Innco Systems	MA4000-EP	303	-
□	Turn Table	Innco Systems	DT2000S-1t	079	-
□	Highpass Filter	Wainwright	WHK2.5/ 18G-10SS	61	14.04.12
□	Highpass Filter	Wainwright	WHKX6.5/ 18G-8SS	2	14.06.05
□	Test Receiver	R & S	843276/003	ESHS10	14.06.15
□	LISN	R & S	100267	ESH3-Z5	13.07.05
□	LISN	Schwarzbeck	8121-472	NNLK8121	13.07.13

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82 31 336 9919 (Main) 82 31 336 4767 (Fax)