RADIO TEST REPORT

For

Shenzhen KVD Communication Equipment Limited

LTE GSM/WCDMA Smartphone

Test Model: S60 Lite

Prepared for	:	Shenzhen KVD Communication Equipment Limited
Address	:	Lenovo R&D Center 2F-B, South First Road, High-tech Park, Nanshan District, Shenzhen, Guangdong, China
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
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Date of receipt of test sample	:	Dec 21, 2017
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	Dec 21, 2017~Jan 03, 2018
Date of Report	:	Jan 03, 2018

CE

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RADIO TEST REPORT
ETSI EN 300 328 V2.1.1 (2016-11)
Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

Report Reference No.	**: LCS171221034AEE**
Date of Issue	: Jan 03, 2018
Testing Laboratory Name	**: Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	: 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure	: Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name.....	**: Shenzhen KVD Communication Equipment Limited**
Address	: Lenovo R&D Center 2F-B, South First Road, High-tech Park, Nanshan District, Shenzhen, Guangdong, China
Test Specification	
Standard	: ETSI EN 300 328 V2.1.1 (2016-11)
Test Report Form No.	: LCSEMC-1.0
TRF Originator.....	: Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	: Dated 2017-06

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Test Item Description.	**: LTE GSM/WCDMA Smartphone**
Trade Mark.....	: DOOGEE
Test Model	: S60 Lite
Ratings	: DC 3.8V by Li-ion Battery(5580mAh) Recharged by DC 5V/7V/3A,9V/2.7A,12V/2A Adapter
Result	**: Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Calvin Weng	Dick Su	
Calvin Weng/ Administrators	Dick Su/ Technique principal	Gavin Liang/ Manager

RADIO -- TEST REPORT

Test Report No. : LCS171011051AE4	Jan 03, 2018 Date of issue

Test Model.....	:	S60 Lite
EUT.....	:	LTE GSM/WCDMA Smartphone
Applicant.....	:	**Shenzhen KVD Communication Equipment Limited**
Address.....	:	Lenovo R&D Center 2F-B, South First Road, High-tech Park, Nanshan District, Shenzhen, Guangdong, China
Telephone.....	:	
Fax.....	:	
Manufacturer.....	:	**Shenzhen KVD Communication Equipment Limited**
Address.....	:	A,3rd floor, Building A2, Silicon valley Digital Industrial Park,22nd of Dafu industrial area,Aobei Community,Guanlan town,Longhua District,shenzhen 518000, China
Telephone.....	:	
Fax.....	:	
Factory.....	:	**Shenzhen KVD Communication Equipment Limited**
Address.....	:	A,3rd floor, Building A2, Silicon valley Digital Industrial Park,22nd of Dafu industrial area,Aobei Community,Guanlan town,Longhua District,shenzhen 518000, China
Telephone.....	:	
Fax.....	:	

Test Result	Positive

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	Jan 03, 2018	Initial Issue	Gavin Liang

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1. GENERAL INFORMATION

1.1. Product Description for Equipment Under Test (EUT)

EUT	:	LTE GSM/WCDMA Smartphone
Test Model	:	S60 Lite
Power Supply	:	DC 3.8V by Li-ion Battery(5580mAh) Recharged by DC 5V/7V/3A,9V/2.7A,12V/2A Adapter
Hardware Version	:	T777_MAIN_PCB_V1.1
Software Version	:	DOOGEE-S60 Lite-Android7.0-20171227
2G	:	
Support Band	:	☒GSM 900 (EU-Band) ☒DCS 1800 (EU-Band) ☒GSM 850 (U.S.-Band) ☒PCS 1900 (U.S.-Band)
Release Version	:	R99
GPRS Class	:	Class 12
EGPRS Class	:	Class 12
Uplink	:	GSM 900: 880MHz ~ 915MHz DCS 1800: 1710MHz ~ 1785MHz
Downlink	:	GSM 900: 925MHz ~ 960MHz DCS 1800: 1805MHz ~ 1880MHz
Type Of Modulation	:	GMSK for GSM/GPRS; GMSK/8PSK for EGPRS
Antenna Description	:	PIFA Antenna, 0dBi(Max.)
Power Class	:	GSM 900: Class 4, DCS 1800: Class 1
3G	:	
Support Band	:	☐WCDMA Band II (U.S.-Band) ☐WCDMA Band V (U.S.-Band) ☒WCDMA Band I (EU-Band) ☒WCDMA Band VIII (EU-Band)
Release Version	:	R99
Uplink	:	WCDMA Band I: 1920MHz ~ 1980MHz WCDMA Band VIII: 880MHz~915MHz
Downlink	:	WCDMA Band I: 2110MHz ~ 2170MHz WCDMA Band VIII: 925MHz~960MHz
Type Of Modulation	:	WCDMA: QPSK; HSDPA/HSUPA: QPSK
Antenna Description	:	PIFA Antenna, 0dBi(Max.)
Power Class	:	Class 3

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LTE	:	
Support Band	:	☒E-UTRA Band 1(EU-Band) ☒E-UTRA Band 3(EU-Band) ☒E-UTRA Band 7(EU-Band) ☒E-UTRA Band 8(EU-Band) ☒E-UTRA Band 20(EU-Band)
LTE Release Version	:	R9
Uplink	:	E-UTRA Band 1: 1920MHz ~ 1980MHz E-UTRA Band 3: 1710MHz~1785MHz E-UTRA Band 7: 2500MHz ~ 2570MHz E-UTRA Band 8: 880MHz ~ 915MHz E-UTRA Band 20: 832MHz ~ 862MHz
Downlink	:	E-UTRA Band 1: 2110MHz ~ 2170MHz E-UTRA Band 3: 1805MHz~1880MHz E-UTRA Band 7: 2620MHz ~ 2690MHz E-UTRA Band 8: 925MHz ~ 960MHz E-UTRA Band 20: 791MHz ~ 821MHz
Type Of Modulation	:	QPSK/16-QAM
Antenna Description	:	PIFA Antenna; 0dBi(Max.) for Band 1,3,7,8,20
Power Class	:	Class 3
Bluetooth	:	
Frequency Range	:	2.402-2.480GHz
Channel Number	:	79 channels for Bluetooth V4.0 (DSS) 40 channels for Bluetooth V4.0 (DTS)
Channel Spacing	:	1MHz for Bluetooth V4.0 (DSS) 2MHz for Bluetooth V4.0 (DTS)
Modulation Type	:	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth V4.0 (DSS) GFSK for Bluetooth V4.0 (DTS)
Bluetooth Version	:	V4.0
Antenna Description	:	PIFA Antenna, -1dBi(Max.)
WIFI(2.4G Band)	:	
Frequency Range	:	2412-2472MHz
Channel Spacing	:	5MHz
Channel Number	:	13 Channel for 20MHz bandwidth(2412~2472MHz) 9 channels for 40MHz bandwidth(2422~2462MHz)
Modulation Type	:	802.11b: DSSS; 802.11g/n: OFDM
Antenna Description	:	PIFA Antenna, -1dBi(Max.)

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GPS Receiver	:	
Receive Frequency	:	1575.42MHz
Channel Number	:	1
Antenna Description	:	PIFA Antenna
FM Receiver	:	
Frequency Range	:	87.5MHz ~ 108MHz
Modulation Type	:	FM
Antenna Description	:	External Antenna(earphone)

Product Information

a) The type of modulation used by the equipment:

☐FHSS

☒other forms of modulation

b) In case of FHSS modulation:

•In case of non-Adaptive Frequency Hopping equipment:

The number of Hopping Frequencies: .....

•In case of Adaptive Frequency Hopping Equipment:

The maximum number of Hopping Frequencies: .....

The minimum number of Hopping Frequencies: .....

The Dwell Time: .....

c) Adaptive / non-adaptive equipment:

☐non-adaptive Equipment

☒adaptive Equipment without the possibility to switch to a non-adaptive mode

☐adaptive Equipment which can also operate in a non-adaptive mode

d) In case of adaptive equipment:

The Channel Occupancy Time implemented by the equipment:

☒The equipment has implemented an LBT based DAA mechanism

- In case of equipment using modulation different from FHSS:

☐The equipment is Frame Based equipment

☒The equipment is Load Based equipment

☐The equipment can switch dynamically between Frame Based and Load Based equipment

The CCA time implemented by the equipment: 20μs

☐The equipment has implemented a non-LBT based DAA mechanism

☐The equipment can operate in more than one adaptive mode

e) In case of non-adaptive Equipment:

The maximum RF Output Power (e.i.r.p.): ..... dBm

The maximum (corresponding) Duty Cycle: .....%

Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):

f) The worst case operational mode for each of the following tests:

- RF Output Power (worst case 802.11b)

DSSS, OFDM

- Power Spectral Density (worst case 802.11b)

DSSS, OFDM

- Duty cycle, Tx-Sequence, Tx-gap

.....

- Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment)

.....

- Hopping Frequency Separation (only for FHSS equipment)

.....

- Medium Utilisation

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.....

- Adaptivity & Receiver Blocking (worst case 802.11b)

DSSS, OFDM

- Occupied Channel Bandwidth (worst case 802.11n20)

DSSS, OFDM

- Transmitter unwanted emissions in the OOB domain (worst case 802.11g)

DSSS, OFDM

- Transmitter unwanted emissions in the spurious domain (worst case 802.11b)

DSSS, OFDM

- Receiver spurious emissions (worst case 802.11b)

DSSS, OFDM

g) The different transmit operating modes (tick all that apply):

☒Operating mode 1: Single Antenna Equipment

☒Equipment with only 1 antenna

☐ Equipment with two diversity antennas but only one antenna active at any moment in time

☐Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)

☐Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming

☐Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

NOTE: Add more lines if more channel bandwidths are supported.

☐Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming

☐Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

NOTE: Add more lines if more channel bandwidths are supported.

h) In case of Smart Antenna Systems:

- The number of Receive chains: .....
- The number of Transmit chains: .....

☐symmetrical power distribution

☐asymmetrical power distribution

In case of beam forming, the maximum beam forming gain: .....

NOTE: Beam forming gain does not include the basic gain of a single antenna.

i) Operating Frequency Range(s) of the equipment:

- Operating Frequency Range 1: 2412MHz to 2472MHz
- Operating Frequency Range 2: 2422MHz to 2462MHz

NOTE: Add more lines if more Frequency Ranges are supported.

j) Occupied Channel Bandwidth(s):

- Occupied Channel Bandwidth: 17.89MHz
- Occupied Channel Bandwidth 2: 36.67MHz

NOTE: Add more lines if more channel bandwidths are supported.

k) Type of Equipment (stand-alone, combined, plug-in radio device, etc.):

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☒Stand-alone
☐Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
☐Plug-in radio device (Equipment intended for a variety of host systems)
Other .....

l) The extreme operating conditions that apply to the equipment:
Operating temperature range:-10° C to 40° C
Details provided are for the: ■stand-alone equipment
☐combined (or host) equipment
☐test jig

m) The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:
• Antenna Type
☒PIFA Antenna
Antenna Gain: -1dBi
If applicable, additional beamforming gain (excluding basic antenna gain): ..... dB
☐Temporary RF connector provided
☐No temporary RF connector provided
☐Dedicated Antennas (equipment with antenna connector)
☐Single power level with corresponding antenna(s)
☐Multiple power settings and corresponding antenna(s)
Number of different Power Levels: 1
Power Level 1: ……. dBm
Power Level 2: ..... dBm
Power Level 3: ..... dBm
NOTE 1: Add more lines in case the equipment has more power levels.
NOTE 2: These power levels are conducted power levels (at antenna connector).

n) The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:
Details provided are for the: ☒stand-alone equipment
☐combined (or host) equipment
☐test jig
Supply Voltage ☐AC mains State AC voltage ……. V
☒ DC State DC voltage : 3.8V

In case of DC, indicate the type of power source
☐Internal Power Supply
☐External Power Supply or AC/DC adapter
☒Battery: 3.8V
☐Other: .....

o) Describe the test modes available which can facilitate testing:
The EUT can transmit in engineering mode.

p) The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):

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IEEE 802.11™

1.2. Objective

This Type approval report is prepared on behalf of **Shenzhen KVD Communication Equipment Limited** in accordance with ETSI EN 300 328 V2.1.1 (2016-11), Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.

The objective is to determine compliance with ETSI EN 300 328 V2.1.1 (2016-11).

1.3. Related Submittal(s)/Grant(s)

No Related Submittals.

1.4. Test Methodology

All measurements contained in this report were conducted with ETSI EN 300 328 V2.1.1 (2016-11).

1.5. Description of Test Facility

FCC Registration Number. is 254912.
Industry Canada Registration Number. is 9642A-1.
ESMD Registration Number. is ARCB0108.
UL Registration Number. is 100571-492.
TUV SUD Registration Number. is SCN1081.
TUV RH Registration Number. is UA 50296516-001

1.6. Support equipment List

Manufacturer	Description	Model	Serial Number	Certificate
--	--	--	--	--

1.7. External I/O

I/O Port Description	Quantity	Cable
USB Port	1	1 m, unshielded
Earphone	1	N/A

1.8. List Of Measuring Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1	X-series USB Peak and Average Power Sensor Aglient	Agilent	U2021XA	MY54080022	2017-10-27	2018-10-26
2	4 CH. Simultaneous Sampling 14 Bits 2MS/s	Agilent	U2531A	MY54080016	2017-10-27	2018-10-26
3	Test Software	Ascentest	AT890-SW	20160630	N/A	N/A
4	RF Control Unit	Ascentest	AT890-RFB	N/A	2017-06-17	2018-06-16
5	ESA-E SERIES SPECTRUM ANALYZER	Agilent	E4407B	MY41440754	2017-11-18	2018-11-17
6	MXA Signal Analyzer	Agilent	N9020A	MY49100040	2017-06-17	2018-06-16
7	SPECTRUM ANALYZER	R&S	FSP	100503	2017-06-17	2018-06-16
8	MXG Vector Signal Generator	Agilent	N5182A	MY47071151	2017-11-18	2018-11-17
9	ESG VECTOR SIGNAL GENERATOR	Agilent	E4438C	MY42081396	2017-11-18	2018-11-17
10	PSG Analog Signal Generator	Agilent	E8257D	MY4520521	2017-11-18	2018-11-17
11	Universal Radio Communication Tester	R&S	CMU 200	105788	2017-06-17	2018-06-16
12	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2017-06-17	2018-06-16
13	RF Control Unit	Tonscend	JS0806-1	N/A	2017-06-17	2018-06-16
14	DC Power Supply	Agilent	E3642A	N/A	2017-11-18	2018-11-17
15	LTE Test Software	Tonscend	JS1120-1	N/A	N/A	N/A
16	Temperature & Humidity Chamber	GUANGZHOU GOGNWEN	GDS-100	70932	2017-10-11	2018-10-10
17	DC Source	CHROMA	62012P-80-60	34782951	2017-10-11	2018-10-10
18	RF Filter	Micro-Tronics	BRC50718	S/N-017	2017-06-17	2018-06-16
19	RF Filter	Micro-Tronics	BRC50719	S/N-011	2017-06-17	2018-06-16
20	RF Filter	Micro-Tronics	BRC50720	S/N-011	2017-06-17	2018-06-16
21	RF Filter	Micro-Tronics	BRC50721	S/N-013	2017-06-17	2018-06-16
22	RF Filter	Micro-Tronics	BRM50702	S/N-195	2017-06-17	2018-06-16
23	Splitter/Combiner	Micro-Tronics	PS2-15	CB11-20	2017-06-17	2018-06-16
24	Splitter/Combiner	Micro-Tronics	CB11-20	N/A	2017-06-17	2018-06-16
25	Attenuator	Micro-Tronics	PAS-8-10	S/N23466	2017-06-17	2018-06-16
26	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2017-06-17	2018-06-16
27	Positioning Controller	MF	MF-7082	/	2017-06-17	2018-06-16
28	EMI Test Software	AUDIX	E3	N/A	2017-06-17	2018-06-16
29	EMI Test Receiver	R&S	ESR 7	101181	2017-06-17	2018-06-16
30	AMPLIFIER	QuieTek	QTK-A2525G	CHM10809065	2017-11-18	2018-11-17
31	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2017-06-23	2018-06-22
32	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2017-05-02	2018-05-01
33	Horn Antenna	EMCO	3115	6741	2017-06-23	2018-06-22
34	RF Cable-R03m	Jye Bao	RG142	CB021	2017-06-17	2018-06-16
35	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2017-06-17	2018-06-16
36	TEST RECEIVER	R&S	ESCI	101142	2017-06-17	2018-06-16
37	RF Cable-CON	UTIFLEX	3102-26886-4	CB049	2017-06-17	2018-06-16

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38	10dB Attenuator	SCHWARZBECK	MTS-IMP136	261115-001-0032	2017-06-17	2018-06-16
39	Artificial Mains	R&S	ENV216	101288	2017-06-17	2018-06-16
40	Power Analyzer Test System	Voltech	PM6000	20000670053	2017-06-17	2018-06-16
41	ESD Simulator	SCHLODER	SESD 230	604035	2017-06-17	2018-06-16
42	RF POWER AMPLIFIER	OPHIR	5225R	1052	2017-03-22	2018-03-21
43	RF POWER AMPLIFIER	OPHIR	5273F	1019	2017-03-24	2018-03-23
44	Stacked Broadband Log Periodic Antenna	SCHWARZBECK	STLP 9128	9128ES-145	2017-04-28	2018-04-27
45	Stacked Mikrowellen Log.-Per Antenna	SCHWARZBECK	STLP 9149	9149-482	2017-04-28	2018-04-27
46	Electric field probe	Narda S.TS./PMM	EP601	611WX70332	2017-02-05	2018-02-04
47	Power Meter	Agilent	E4419B	MY45104493	2017-06-17	2018-06-16
48	Power Sensor	Agilent	E9301H	MY41495234	2017-06-17	2018-06-16
49	Power Sensor	Agilent	E4412A	MY41500229	2017-06-17	2018-06-16
50	Immunity Simulative Generator	EM TEST	UCS500-M4	0101-34	2017-11-18	2018-11-17
51	Simulator	FRANKONIA	CIT-10	A126A1195	2017-06-17	2018-06-16
52	CDN	FRANKONIA	CDN-M2	5100100100	2017-06-17	2018-06-16
53	CDN	FRANKONIA	CDN-M3	0900-11	2017-06-17	2018-06-16
54	Attenuator	FRANKONIA	ATT6	0010222A	2017-06-17	2018-06-16
55	Infuse tongs	EM TEST	EM-Clamp	0513A031201	2017-06-17	2018-06-16
56	Voltage dips and up generator	3CTEST	VDG-1105G	EC0171014	2017-06-17	2018-06-16
Note: All equipment is calibrated through GUANGZHOU LISAI CALIBRATION AND TEST CO.,LTD.						

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1.9. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Occupied Channel Bandwidth	5 %
RF output power, conducted	1,5 dB
Power Spectral Density, conducted	3 dB
Unwanted Emissions, conducted	3 dB
All emissions, radiated	6 dB
Temperature	1 °C
Humidity	5 %
DC and low frequency voltages	3 %
Time	5 %
Duty Cycle	5 %

1.10. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	25
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950-1000

1.11. Description Of Test Modes

LCS has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmit by 802.11b
Mode 2: Transmit by 802.11g
Mode 3: Transmit by 802.11n(20MHz)
Mode 4: Transmit by 802.11n(40MHz)
Mode 5: Receive by 802.11b
Mode 6: Receive by 802.11g
Mode 7: Receive by 802.11n(20MHz)
Mode 8: Receive by 802.11n(40MHz)

Note:

(1) For portable device, radiated spurious emission was verified over X, Y, Z Axis, and shown the worst case on this report.

(2) Regard to the frequency band operation for systems using Wide Band modulation: the lowest, middle, highest frequency channel for conducted test, and the lowest, highest frequency channel for radiation spurious test.

(3) The extreme test condition for voltage and temperature were declared by the manufacturer.

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2. SYSTEM TEST CONFIGURATION

2.1. Justification

The system was configured for testing in engineering mode.

2.2. EUT Exercise Software

N/A.

2.3. Special Accessories

N/A.

2.4. Block Diagram/Schematics

Please refer to the related document.

2.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

2.6. Configuration of Test Setup

Please refer to the test setup photo.

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3. SUMMARY OF TEST RESULT

☒ No deviations from the test standards

☐ Deviations from the test standards as below description:

Technical requirements for the equipment using wide band modulations other than FHSS:

Performed Test Item	Normative References	Test Performed	Deviation
RF Output Power & Receiver Category	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Power Spectral Density	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Duty cycle, Tx-Sequence, Tx-gap	ETSI EN 300 328 V2.1.1 (2016-11)	N/A	N/A
Medium Utilisation (MU) factor	ETSI EN 300 328 V2.1.1 (2016-11)	N/A	N/A
Adaptivity	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Occupied Channel Bandwidth	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Transmitter unwanted emissions in the out-of-band domain	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Transmitter unwanted emissions in the spurious domain	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Receiver Spurious Emissions	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Receiver Blocking	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No

Note:
1. The EUT can operate in an adaptive mode, and can't operate in a non-adaptive mode which is stated by the supplier.
2. The EUT is equipment which using wide band modulations other than FHSS. It is an adaptive equipment which can't operate in non-adaptive mode.

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4. RF OUTPUT POWER

4.1. Limit

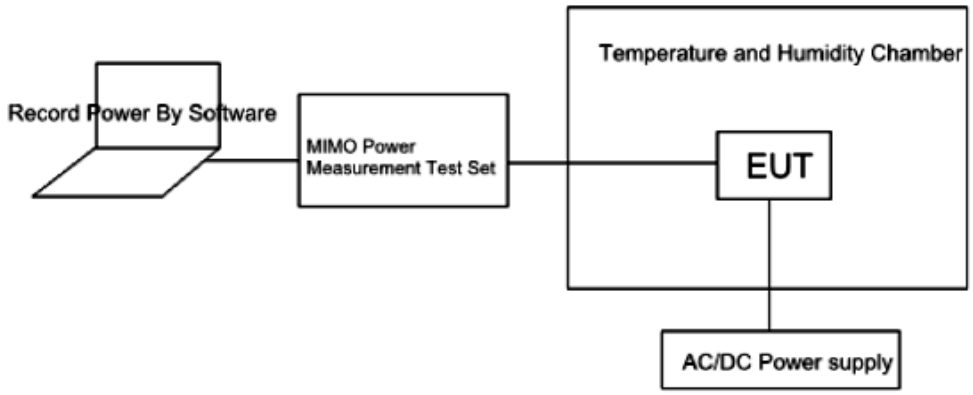
For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20 dBm.

The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed 20 dBm. For non-adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be equal to or less than the value declared by the supplier.

This limit shall apply for any combination of power level and intended antenna assembly.

4.2. Test Setup

For Conducted Measurement



4.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.2

Step 1:

• The fast power sensor use the following setting: Sample speed 1 MS/s.

Step 2:

• Connect the power sensor to the transmit port, sample the transmit signal and store the raw data. Use these stored samples in all following steps.

Step 3:

• Find the start and stop times of each burst in the stored measurement samples.

Step 4:

• Between the start and stop times of each individual burst calculate the RMS power over the burst. Save these Pburst values, as well as the start and stop times for each burst.

Step 5:

• The highest of all Pburst values (value "A" in dBm) will be used for maximum e.i.r.p. calculations.

Step 6:

• Add the (stated) antenna assembly gain "G" in dBi of the individual antenna.

• If applicable, add the additional beamforming gain "Y" in dB.

The RF Output Power (P) shall be calculated using the formula below:
P = A + G + Y

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4.4. Test Result

Pass

***Note: 20 bursts had been captured for power measurement.

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	RF Output Power
Test Mode	:	Mode 1: Transmit by 802.11b

Test Conditions		Frequency (MHz)	RF Output Power EIRP (dBm)	Limit (dBm)
Tnom (25℃)	Vnom (DC 3.8V)	2412	13.84	20
		2442	14.20	
		2472	14.18	
Tmax (40℃)	Vnom (DC 3.8V)	2412	13.88	20
		2442	14.28	
		2472	14.12	
Tmin (-10℃)	Vnom (DC 3.8V)	2412	13.70	20
		2442	14.13	
		2472	**14.53**	

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	RF Output Power
Test Mode	:	Mode 2: Transmit by 802.11g

Test Conditions		Frequency (MHz)	RF Output Power EIRP (dBm)	Limit (dBm)
Tnom (25℃)	Vnom (DC 3.8V)	2412	12.77	20
		2442	13.15	
		2472	13.16	
Tmax (40℃)	Vnom (DC 3.8V)	2412	12.79	20
		2442	13.09	
		2472	13.07	
Tmin (-10℃)	Vnom (DC 3.8V)	2412	12.70	20
		2442	13.17	
		2472	13.15	

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	RF Output Power
Test Mode	:	Mode 3: Transmit by 802.11n(20MHz)

Test Conditions		Frequency (MHz)	RF Output Power EIRP (dBm)	Limit (dBm)
Tnom (25℃)	Vnom (DC 3.8V)	2412	11.85	20
		2442	12.28	
		2472	12.30	
Tmax (40℃)	Vnom (DC 3.8V)	2412	11.93	20
		2442	12.32	
		2472	12.33	
Tmin (-10℃)	Vnom (DC 3.8V)	2412	11.77	20
		2442	12.26	
		2472	12.32	

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	RF Output Power
Test Mode	:	Mode 4: Transmit by 802.11n(40MHz)

Test Conditions		Frequency (MHz)	RF Output Power EIRP (dBm)	Limit (dBm)
Tnom (25℃)	Vnom (DC 3.8V)	2422	10.81	20
		2442	10.94	
		2462	11.39	
Tmax (40℃)	Vnom (DC 3.8V)	2422	10.73	20
		2442	10.96	
		2462	11.41	
Tmin (-10℃)	Vnom (DC 3.8V)	2422	10.78	20
		2442	10.96	
		2462	11.30	

4.5. Receiver Category

Receiver Category 1: Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receiver category 1 equipment.

Receiver Category 2:Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or adaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2 equipment.

Receiver Category 3: Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3 equipment.

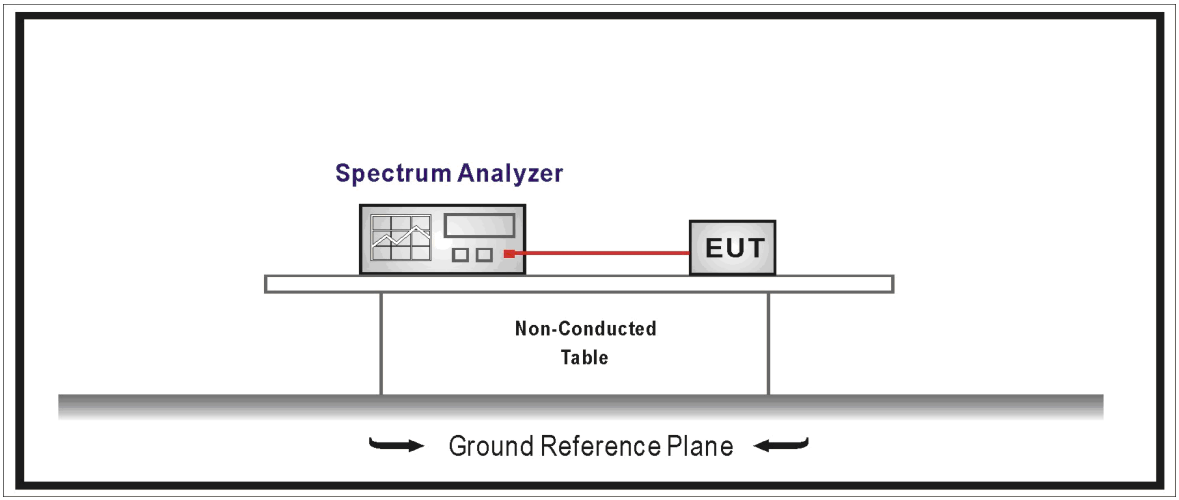
As this an adaptivity device with a maximum power of 14.53dBm, **it belongs to recevier category 1**.

5. POWER SPECTRAL DENSITY

5.1. Limit

For equipment using wide band modulations other than FHSS, the maximum Power Spectral Density is limited to 10dBm per MHz.

5.2. Test Setup



5.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.3

Step 1:

Connect the UUT to the spectrum analyser and use the following settings:

- Start Frequency: 2 400 MHz
- Stop Frequency: 2 483,5 MHz
- Resolution BW: 10 kHz
- Video BW: 30 kHz
- Sweep Points: > 8 350
- Detector: RMS
- Trace Mode: Max Hold
- Sweep time: Auto

For non-continuous signals, wait for the trace to be completed. Save the (trace) data set to a file.

Step 2:

For each frequency point, add up the amplitude (power) values for the different transmit chains and use this as the new data set.

Step 3:

Add up the values for amplitude (power) for all the samples in the file.

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Step 4:

Normalize the individual values for amplitude so that the sum is equal to the RF Output Power (e.i.r.p.).

Step 5:

Starting from the first sample in the file (lowest frequency), add up the power of the following samples representing a 1 MHz segment and record the results for power and position (i.e. sample #1 to #100). This is the Power Spectral Density (e.i.r.p.) for the first 1 MHz segment which shall be recorded.

Step 6:

Shift the start point of the samples added up in step 5 by 1 sample and repeat the procedure in step 5 (i.e. sample #2 to #101).

Step 7:

Repeat step 6 until the end of the data set and record the radiated Power Spectral Density values for each of the 1 MHz segments. From all the recorded results, the highest value is the maximum Power Spectral Density for the UUT.

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5.4. Test Result

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Maximum Spectral Power Density
Test Mode	:	Mode 1: Transmit by 802.11b

Frequency (MHz)	Total Power Density (dBm/MHz)	Limit (dBm/MHz)
2412	2.82	10.00
2442	3.17	10.00
2472	3.32	10.00

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Maximum Spectral Power Density
Test Mode	:	Mode 2: Transmit by 802.11g

Frequency (MHz)	Total Power Density (dBm/MHz)	Limit (dBm/MHz)
2412	-1.21	10.00
2442	-0.72	10.00
2472	-0.44	10.00

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Maximum Spectral Power Density
Test Mode	:	Mode 3: Transmit by 802.11n(20MHz)

Frequency (MHz)	Total Power Density (dBm/MHz)	Limit (dBm/MHz)
2412	-3.14	10.00
2442	-2.95	10.00
2472	-2.74	10.00

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Maximum Spectral Power Density
Test Mode	:	Mode 4: Transmit by 802.11n(40MHz)

Frequency (MHz)	Total Power Density (dBm/MHz)	Limit (dBm/MHz)
2422	-4.22	10.00
2442	-4.00	10.00
2462	-3.43	10.00

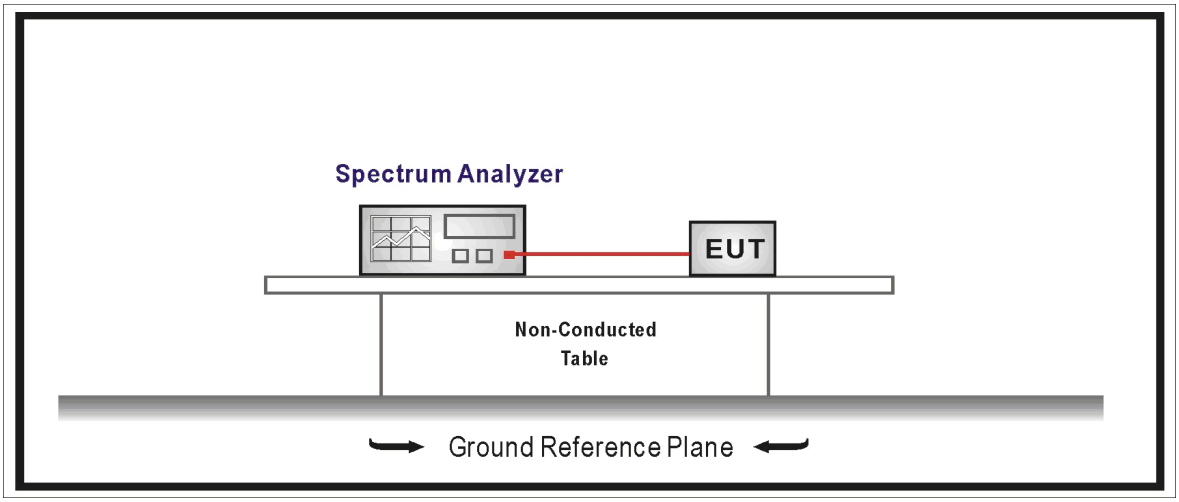
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6. DUTY CYCLE, TX-SEQUENCE, TX-GAP

6.1. Limit

The Duty Cycle shall be equal to or less than the maximum value declared by the supplier.
The Tx-sequence time shall be equal to or less than 10 ms. The minimum Tx-gap time following a Tx-sequence shall be equal to the duration of that proceeding Tx-sequence with a minimum of 3,5 ms.

6.2. Test Setup



6.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.2

6.4. Test Result

These requirements apply to non-adaptive equipment or to adaptive equipment when operating in a non-adaptive mode. The equipment is using wide band modulations other than FHSS.
These requirements do not apply for equipment with a maximum declared RF Output power of less than 10dBm E.I.R.P. or for equipment when operating in a mode where the RF Output power is less than 10dBm E.I.R.P.
No applicable.

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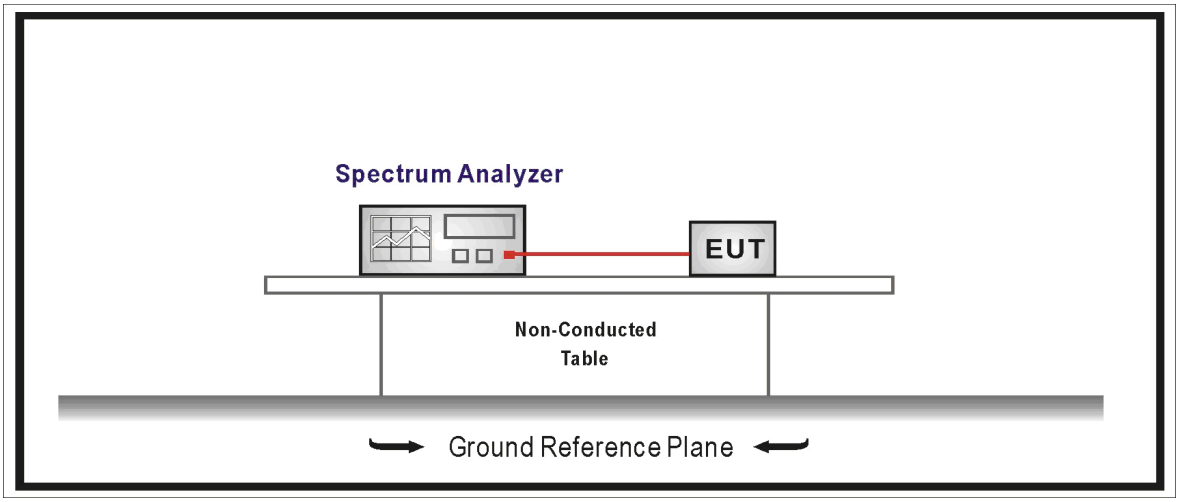
7. MEDIUM UTILISATION (MU) FACTOR

7.1. Limit

For non-adaptive equipment

For non-adaptive equipment using wide band modulations other than FHSS, the maximum Medium Utilization factor shall be 10 %.

7.2. Test Setup



7.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.2

7.4. Test Result

This requirement does not apply to adaptive equipment unless operating in a non-adaptive mode.
In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10dBm E.I.R.P. or for equipment when operating in a mode where the RF Output power is less than 10dBm E.I.R.P.
No applicable.

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8. ADAPTIVITY

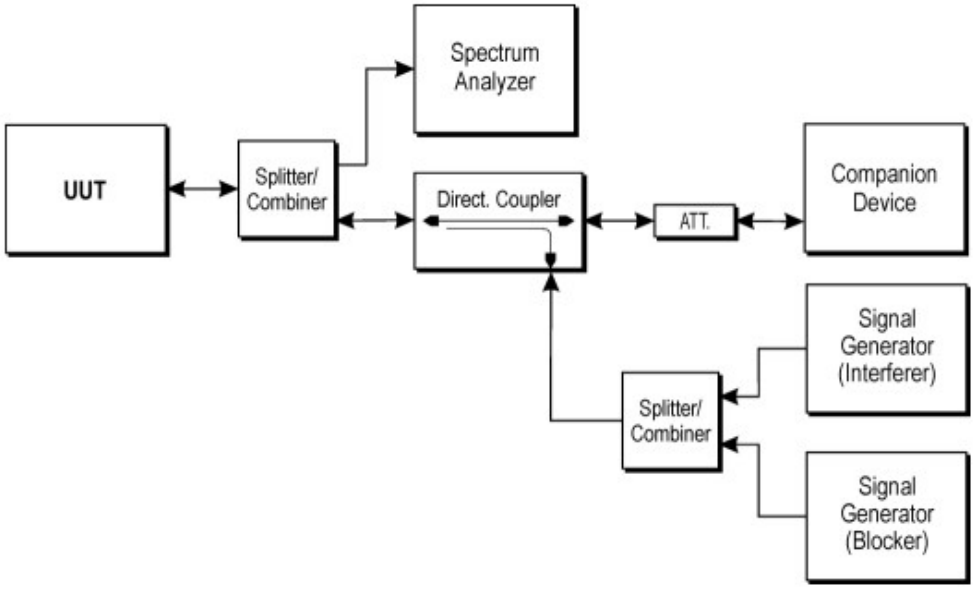
8.1. Limit

Adaptivity Limit
☐ Non-LBT based Detect and Avoid --- The channel shall remain unavailable for a minimum time equal to 1 s after which the channel may be considered again as an 'available' channel; --- COT ≤ 40 ms; --- Idle Period shall be minimum 5% of COT with a minimum of 100us; --- Detection threshold level = -70dBm/MHz + (20dBm – Pout e.i.r.p)/1MHz (Pout in dBm);
☐ LBT based Detect and Avoid(Frame Based Equipment) --- The CCA observation time shall be not less than 18 us; --- COT = 1-10 ms; --- Idle Period = 5% of COT; --- Detection threshold level = -70dBm/MHz + (20dBm – Pout e.i.r.p)/1MHz (Pout in dBm);
☒ LBT based Detect and Avoid(Load Based Equipment) --- The CCA observation time shall be not less than 18 us; --- COT ≤ 13 ms; --- Detection threshold level = -70dBm/MHz + (20dBm – Pout e.i.r.p)/1MHz (Pout in dBm);
☐ Short Control Signalling Transmissions: --- Short Control Signalling Transmissions shall have have a maximum TxOn / (TxOn + TxOff) ratio of 10 % within any observation period of 50 ms.

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8.2. Test Setup

Conducted measurements



8.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.7

1) The EUT connect to a companion device during the test. Adjust the received signal level at the EUT to the value defined in table 6 of ETSI EN 300 328 V2.1.1 (2016-11) Clause 4.3.2.10.2
2) the analyzer shall be set as below: RBW=8MHz and VBW=28MHz.
3) Configure the EUT for normal transmission with a sufficiently high payload to allow demonstration of compliance of the adaptive mechanism on the channel being tested.
4) Adding the interference signal and blocking signal.
5) Record the data.

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8.4. Test Result

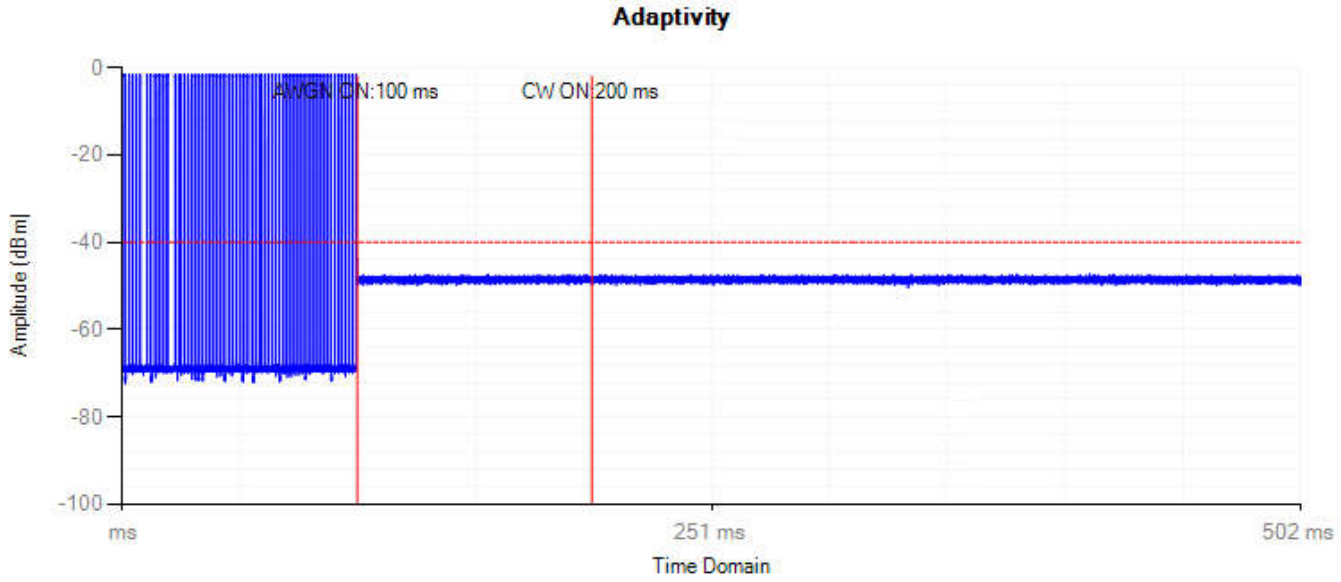
Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Adaptivity
Test Result	:	Pass

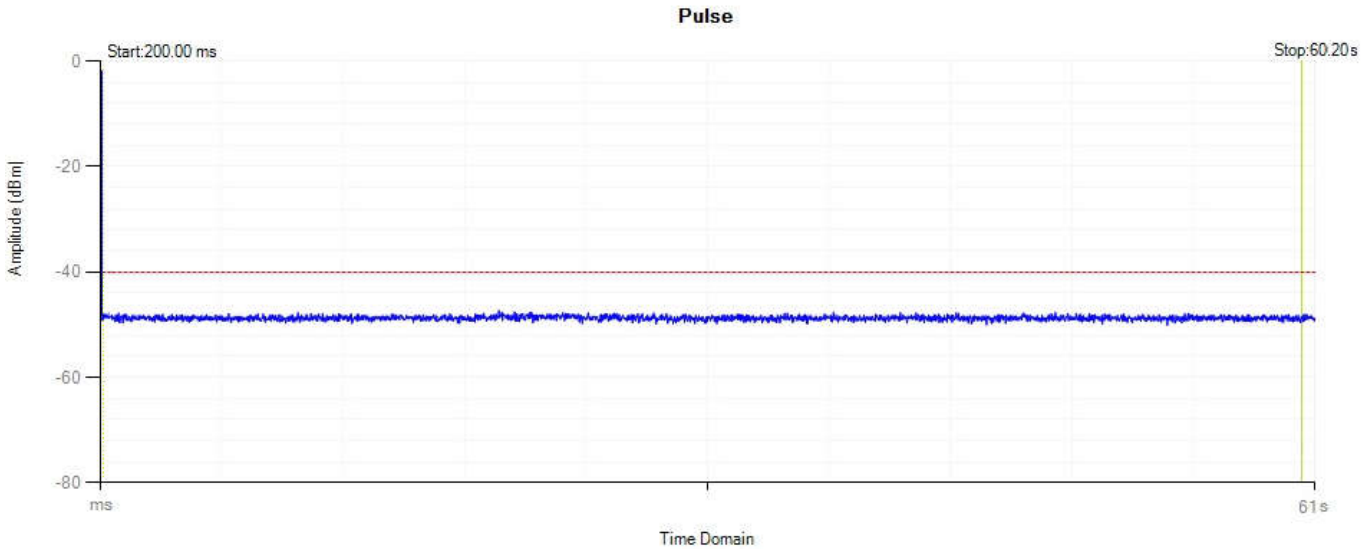
Summary Of Test Result		
Test Mode	Channel	Conclusion
802.11b	Low	Pass
	High	Pass
802.11g	Low	Pass
	High	Pass
802.11n20	Low	Pass
	High	Pass
802.11n40	Low	Pass
	High	Pass
Note: All modulation of EUT which maximum output power is more than 10dbm have been tested.		

The Worst Test Mode	802.11b: Low Channel
AWGN Interference Level (dBm)	-64.79
Blocking Interference Level (dBm)	-35
Interference Start Time (ms)	100
Stop time after interfering signal(ms)	100
Blocking ON Time (ms)	200
Suggest q Level	4
Max. COT (ms)	3.82
Pulse width (ms)	0
Duty Cycle (%)	0
The Worst Test Mode	802.11b: High Channel
AWGN Interference Level (dBm)	-64.57
Blocking Interference Level (dBm)	-35
Interference Start Time (ms)	100
Stop time after interfering signal(ms)	100
Blocking ON Time (ms)	200
Suggest q Level	4
Max COT (ms)	2.85
Pulse width (ms)	0
Duty Cycle (%)	0

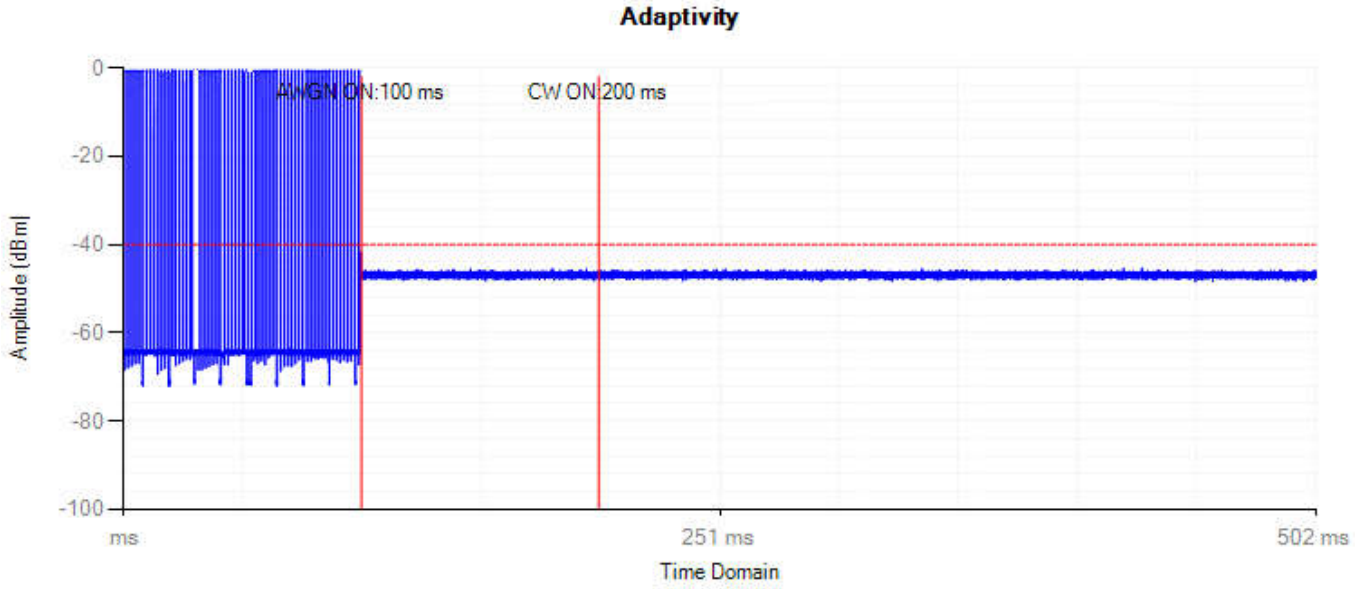
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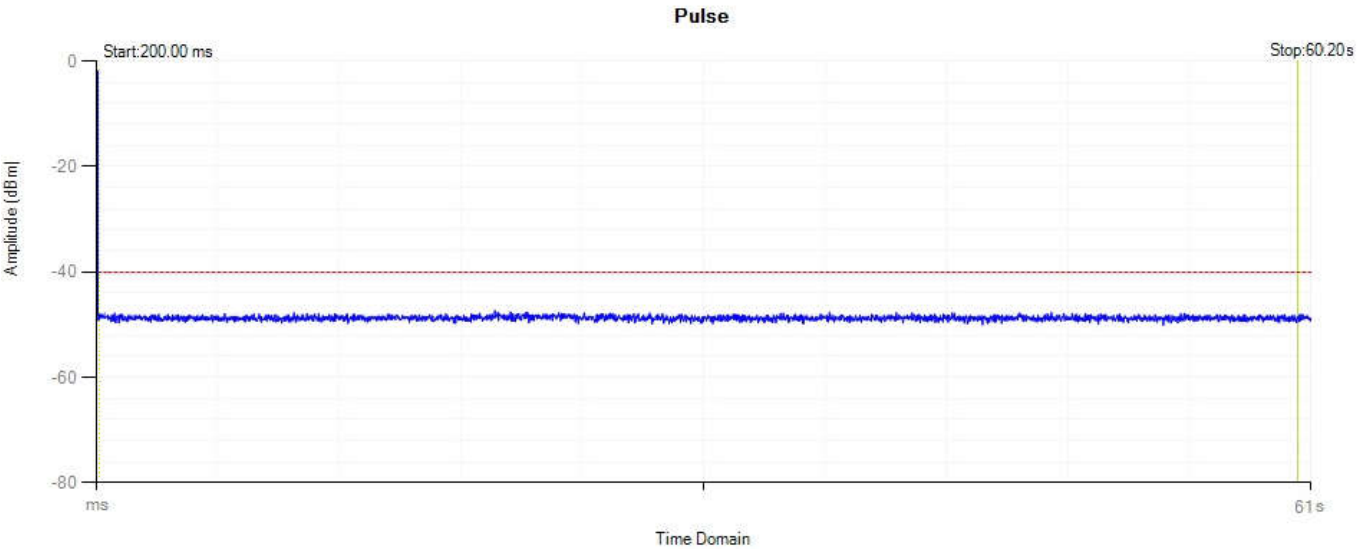
Test plot (802.11b-Low channel):





Test plot (802.11b-High channel):

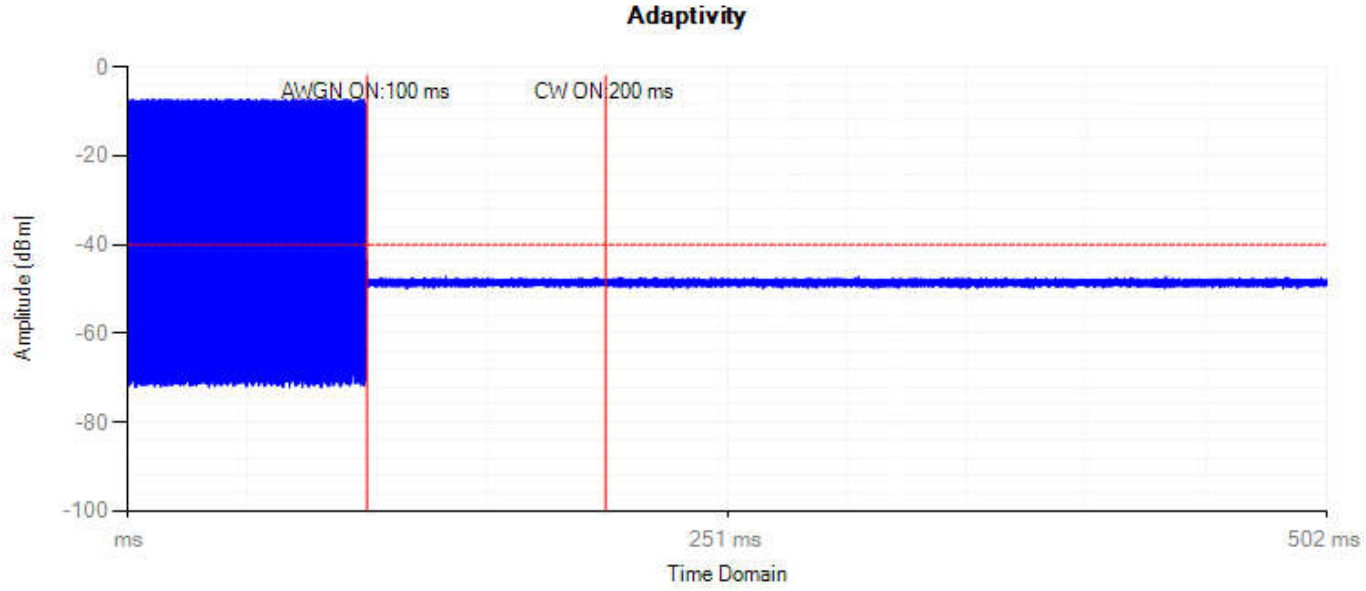


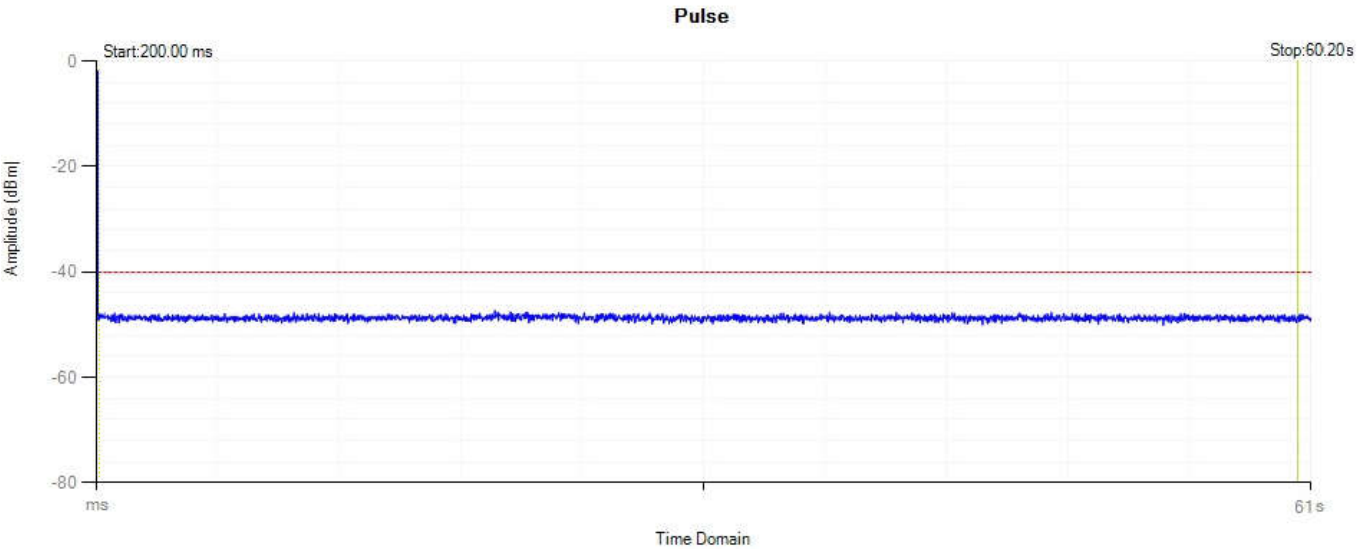


Test Mode	802.11g: Low Channel
AWGN Interference Level (dBm)	-63.94
Blocking Interference Level (dBm)	-35
Interference Start Time (ms)	100
Stop time after interfering signal(ms)	100
Blocking ON Time (ms)	200
Suggest q Level	4
Max COT (ms)	2.55
Pulse width (ms)	0
Duty Cycle (%)	0
Test Mode	802.11g: High Channel
AWGN Interference Level (dBm)	-63.73
Blocking Interference Level (dBm)	-35
Interference Start Time (ms)	100
Stop time after interfering signal(ms)	100
Blocking ON Time (ms)	200
Suggest q Level	4
Max COT (ms)	2.57
Pulse width (ms)	0
Duty Cycle (%)	0

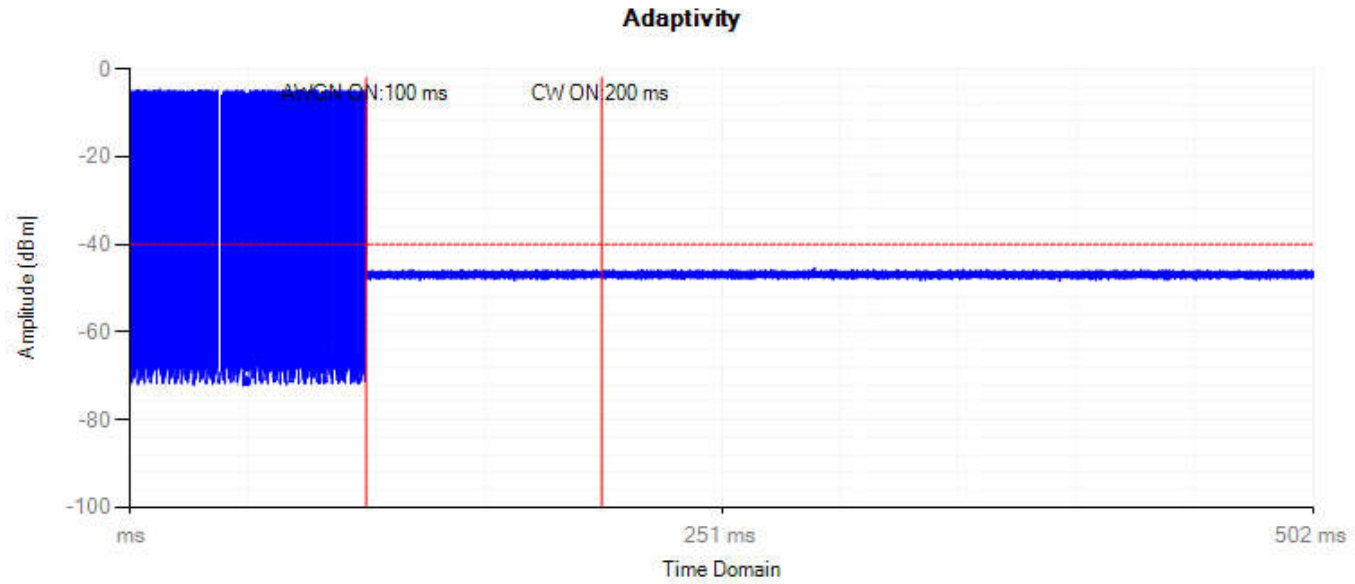
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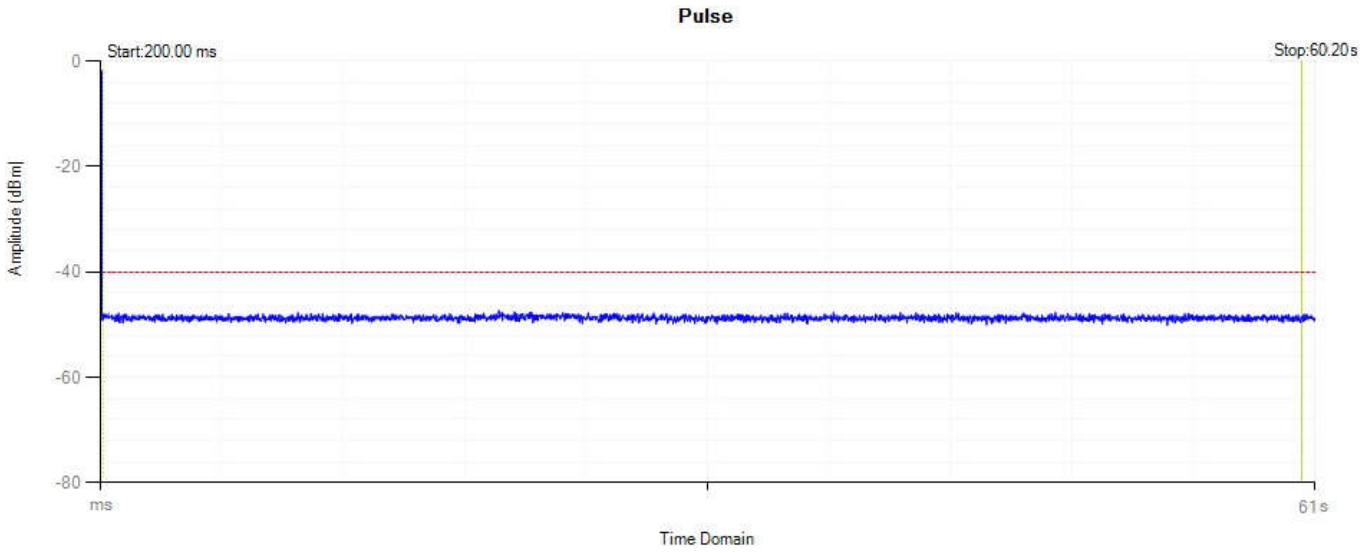
Test plot (802.11g-Low channel):





Test plot (802.11g-High channel):

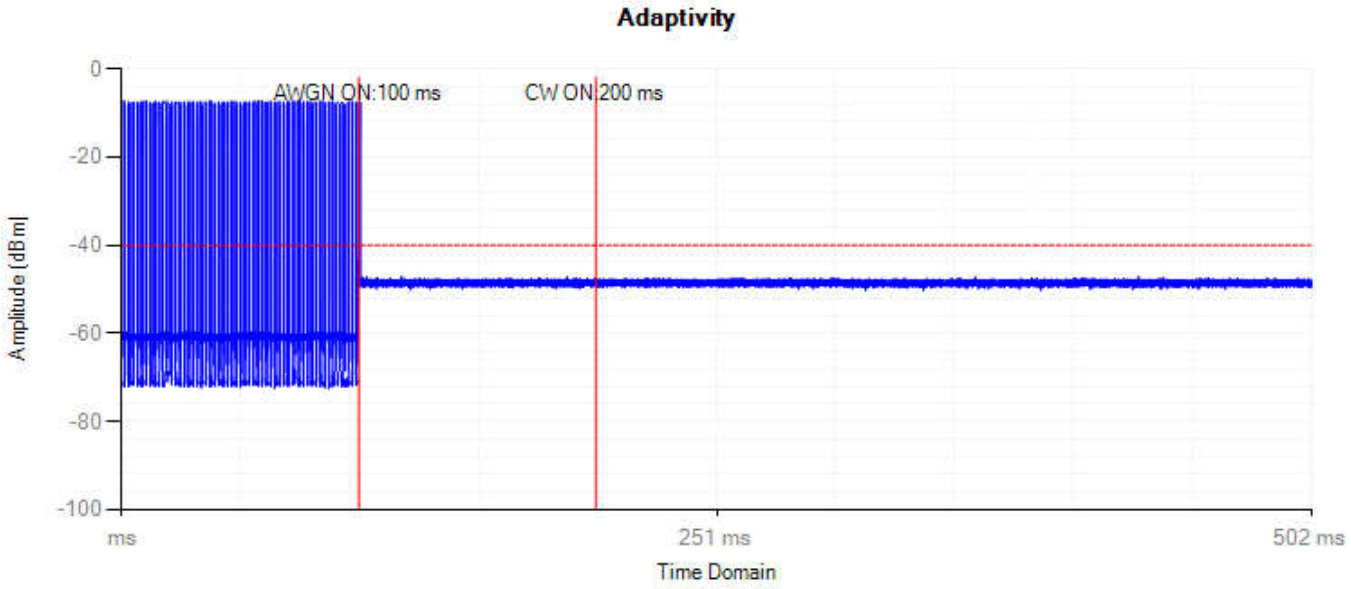


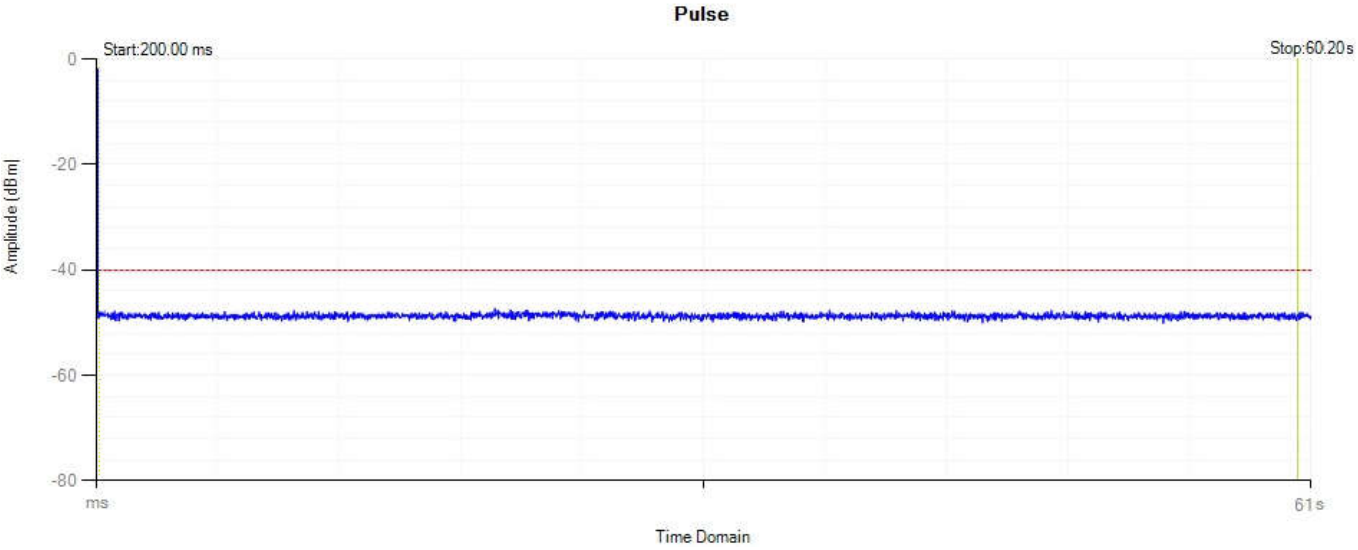


The Worst Test Mode	802.11n20: Low Channel
AWGN Interference Level (dBm)	-62.85
Blocking Interference Level (dBm)	-35
Interference Start Time (ms)	100
Stop time after interfering signal(ms)	100
Blocking ON Time (ms)	200
Suggest q Level	4
Max. COT (ms)	2.47
Pulse width (ms)	0
Duty Cycle (%)	0
The Worst Test Mode	802.11n20: High Channel
AWGN Interference Level (dBm)	-62.46
Blocking Interference Level (dBm)	-35
Interference Start Time (ms)	100
Stop time after interfering signal(ms)	100
Blocking ON Time (ms)	200
Suggest q Level	4
Max COT (ms)	2.78
Pulse width (ms)	0
Duty Cycle (%)	0

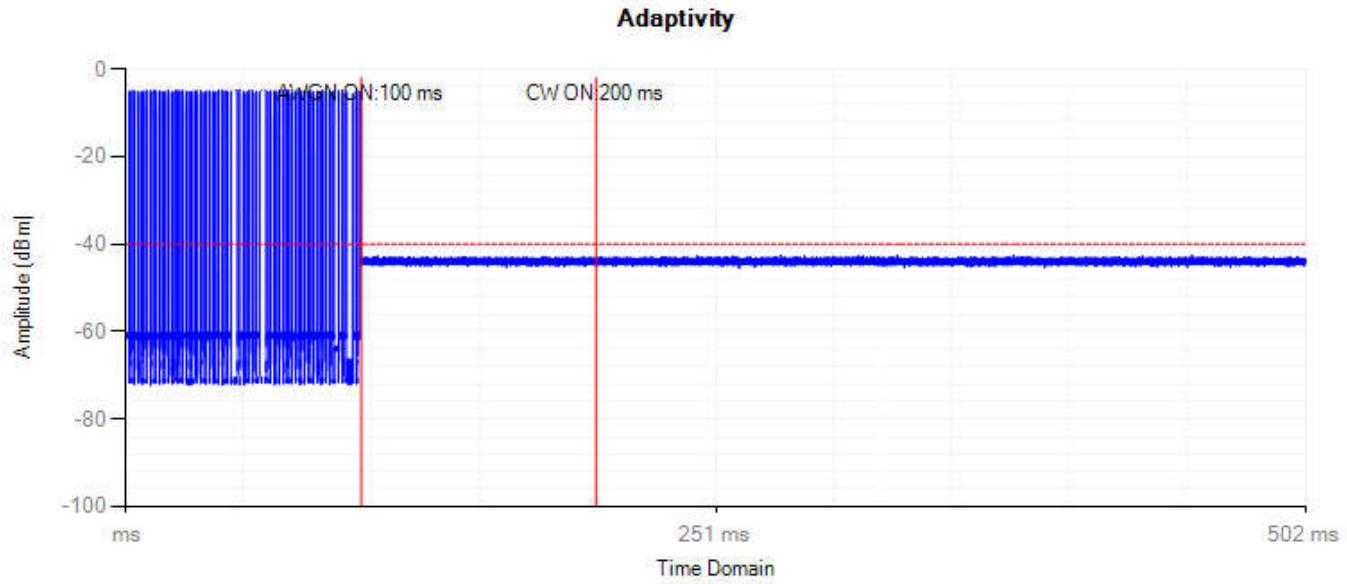
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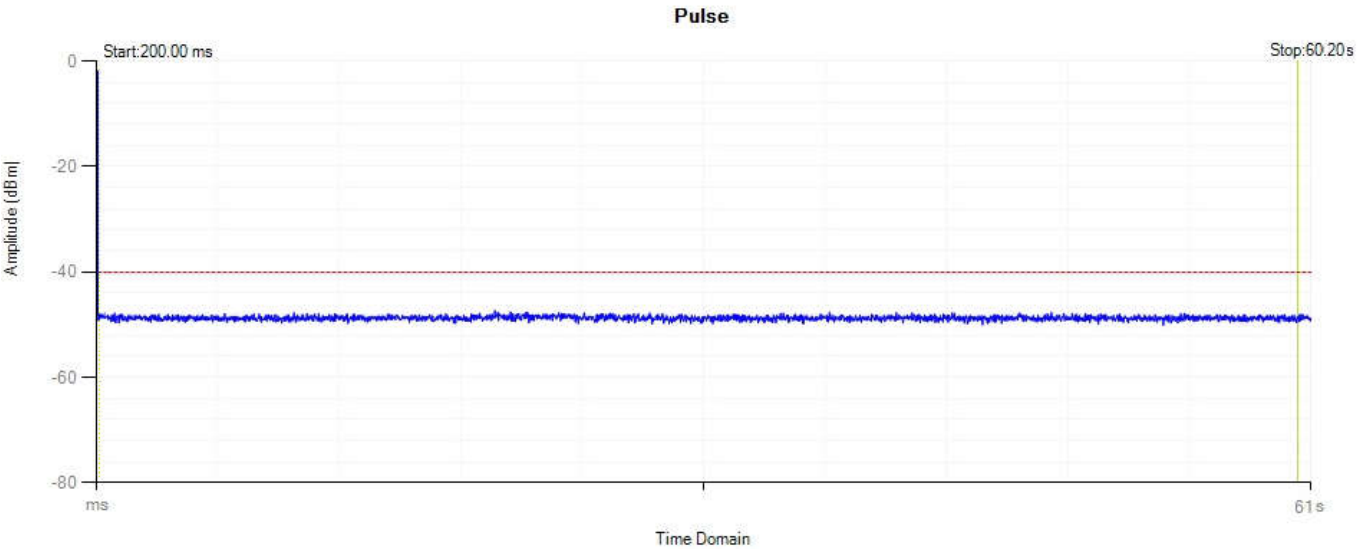
Test plot (802.11n20-Low channel):





Test plot (802.11n20-High channel):

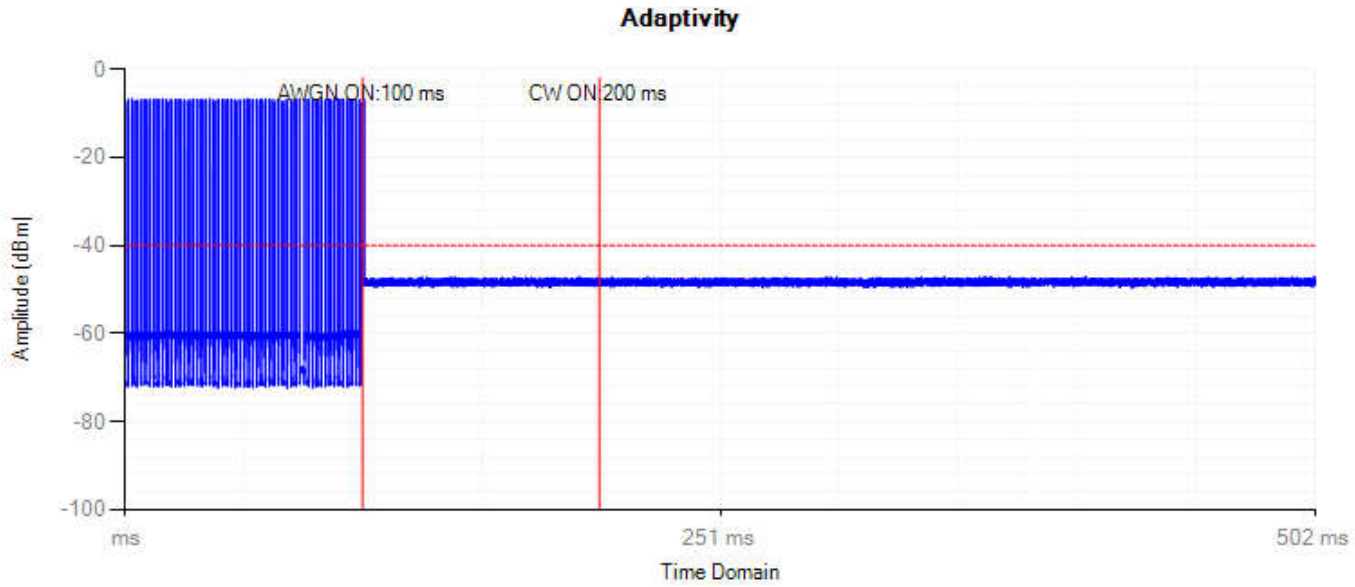


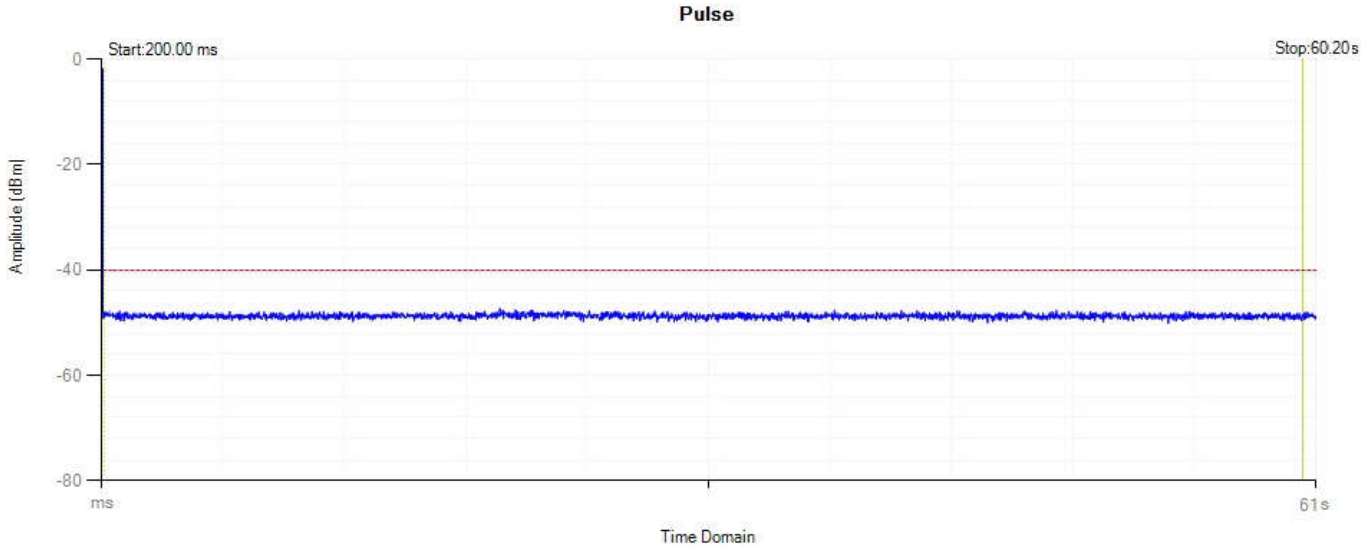


The Worst Test Mode	802.11n40: Low Channel
AWGN Interference Level (dBm)	-61.88
Blocking Interference Level (dBm)	-35
Interference Start Time (ms)	100
Stop time after interfering signal(ms)	100
Blocking ON Time (ms)	200
Suggest q Level	4
Max. COT (ms)	2.52
Pulse width (ms)	0
Duty Cycle (%)	0
The Worst Test Mode	802.11n40: High Channel
AWGN Interference Level (dBm)	-61.74
Blocking Interference Level (dBm)	-35
Interference Start Time (ms)	100
Stop time after interfering signal(ms)	100
Blocking ON Time (ms)	200
Suggest q Level	4
Max COT (ms)	2.19
Pulse width (ms)	0
Duty Cycle (%)	0

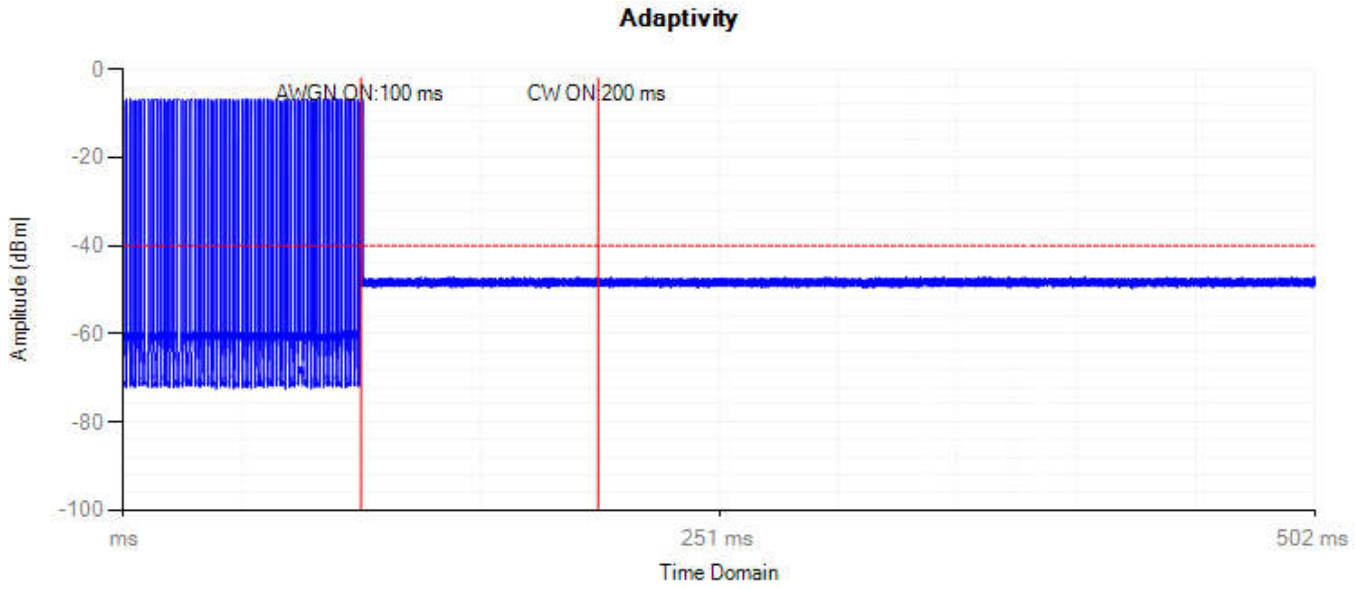
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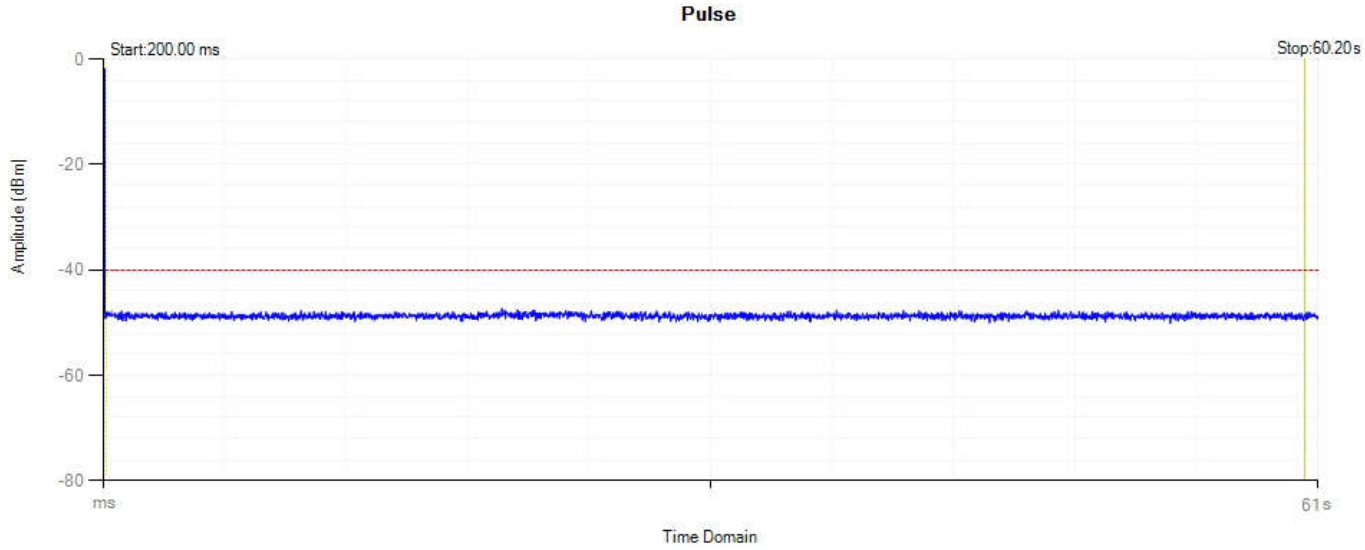
Test plot (802.11n40-Low channel):





Test plot (802.11n40-High channel):





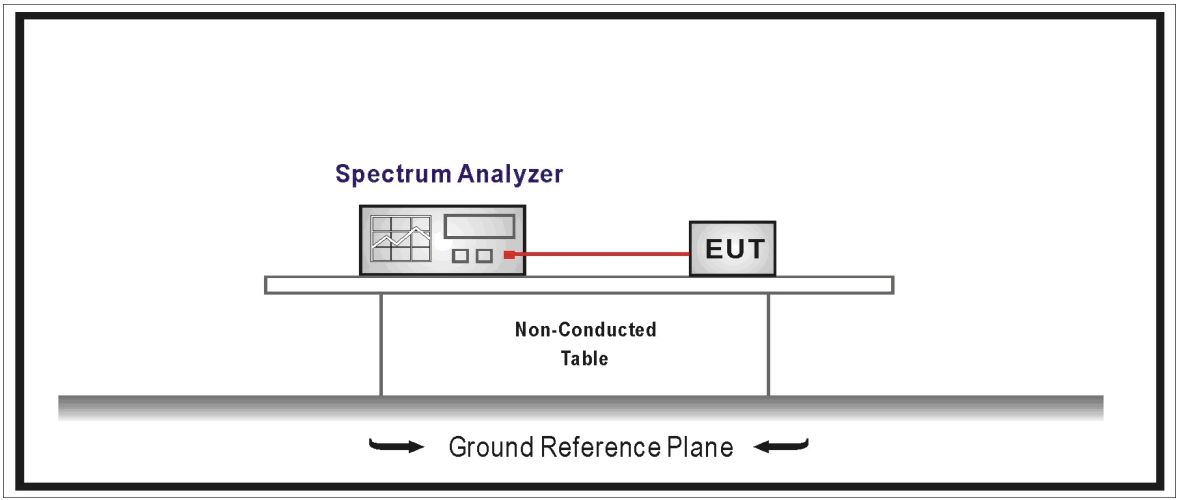
9. OCCUPIED CHANNEL BANDWIDTH

9.1. Limit

The Occupied Channel Bandwidth shall fall completely within the band given in 2.4GHz to 2.4835GHz.

In addition, for non-adaptive systems using wide band modulations other than FHSS and with e.i.r.p greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

9.2. Test Setup



9.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.8

Step 1:

Connect the UUT to the spectrum analyser and use the following settings:

• Centre Frequency: The centre frequency of the channel under test

• Resolution BW: ~ 1 % of the span without going below 1 %

(we set RBW=430KHz for 802.11b/g/n20 and 1MHz for 802.11n40)

• Video BW: 3 × RBW (we set VBW=1.2MHz for 802.11b/g/n20 and 3MHz for 802.11n40)

• Frequency Span: 2 × Occupied Channel Bandwidth

(we set Span=40MHz(for 802.11b/g/n20) & 80MHz(for 802.11n40))

• Detector Mode: RMS

• Trace Mode: Max Hold

Step 2:

Wait until the trace is completed. Find the peak value of the trace and place the analyser marker on this peak.

Step 3:

Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.

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9.4. Test Result

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Occupied Channel Bandwidth
Test Mode	:	Mode 1: Transmit by 802.11b

Channel No.	Frequency (MHz)	99% Bandwidth (MHz)	Limit
01	2412	12.54	Within the band 2400.0MHz~2483.5MHz
13	2472	12.83	

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Occupied Channel Bandwidth
Test Mode	:	Mode 2: Transmit by 802.11g

Channel No.	Frequency (MHz)	99% Bandwidth (MHz)	Limit
01	2412	17.04	Within the band 2400.0MHz~2483.5MHz
13	2472	17.31	

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Occupied Channel Bandwidth
Test Mode	:	Mode 3: Transmit by 802.11n(20MHz)

Channel No.	Frequency (MHz)	99% Bandwidth (MHz)	Limit
01	2412	17.91	Within the band 2400.0MHz~2483.5MHz
13	2472	18.10	

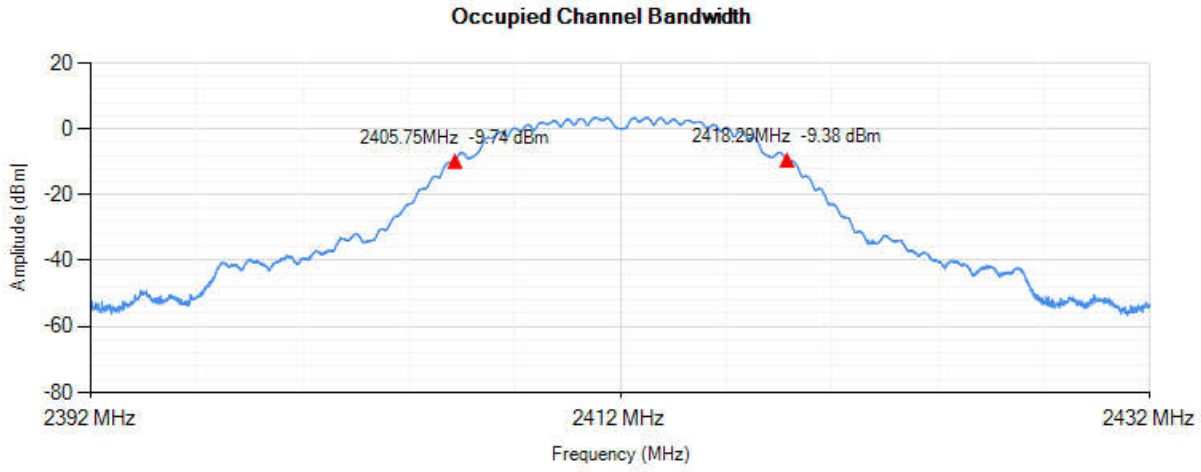
Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Occupied Channel Bandwidth
Test Mode	:	Mode 4: Transmit by 802.11n(40MHz)

Channel No.	Frequency (MHz)	99% Bandwidth (MHz)	Limit
03	2422	36.61	Within the band 2400.0MHz~2483.5MHz
11	2462	36.42	

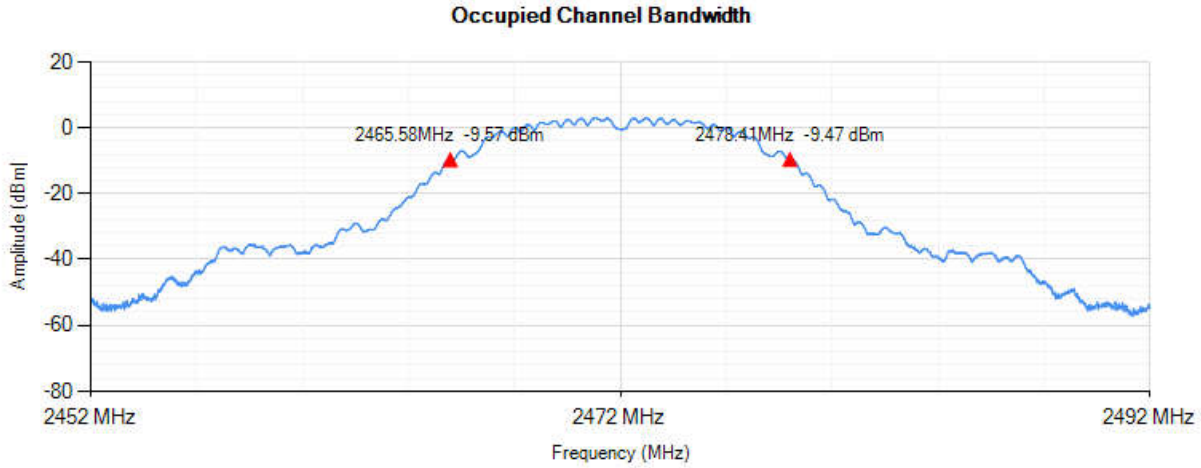
Test Result	:	Pass

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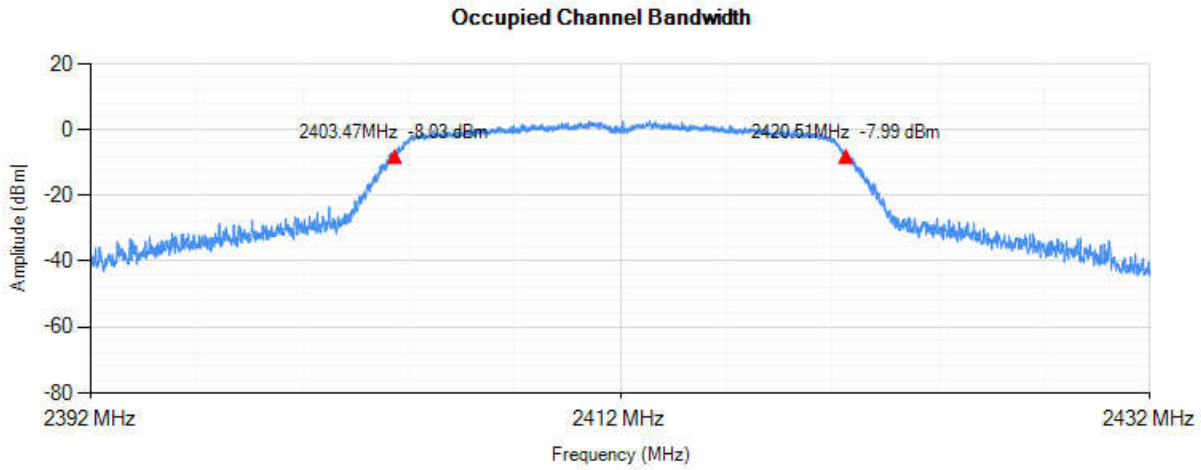
802.11b-Low channel



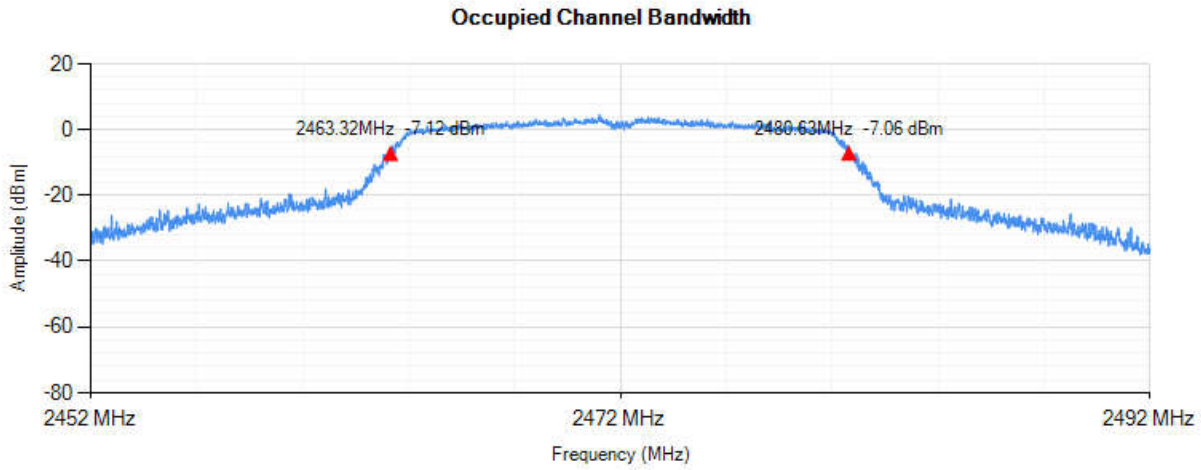
802.11b-High channel



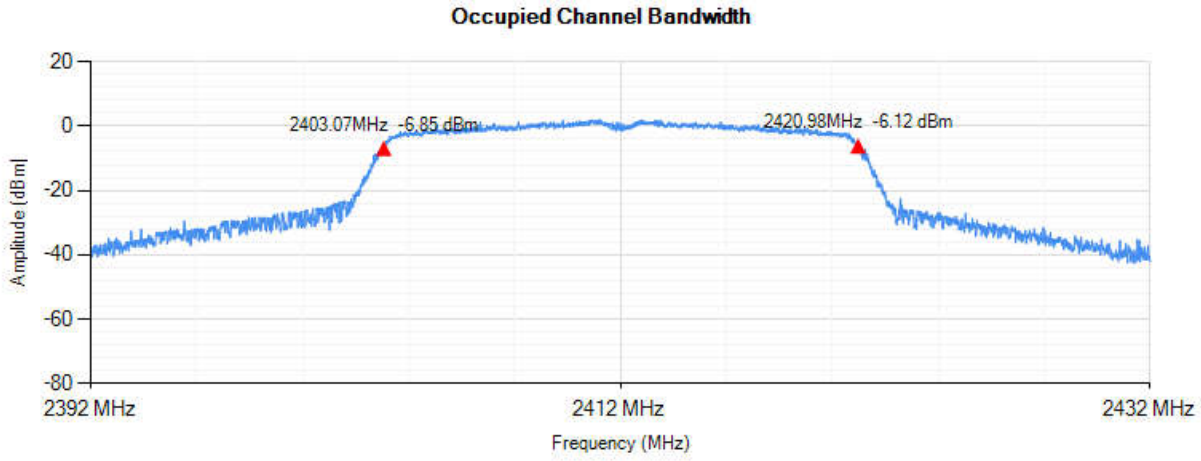
802.11g-Low channel



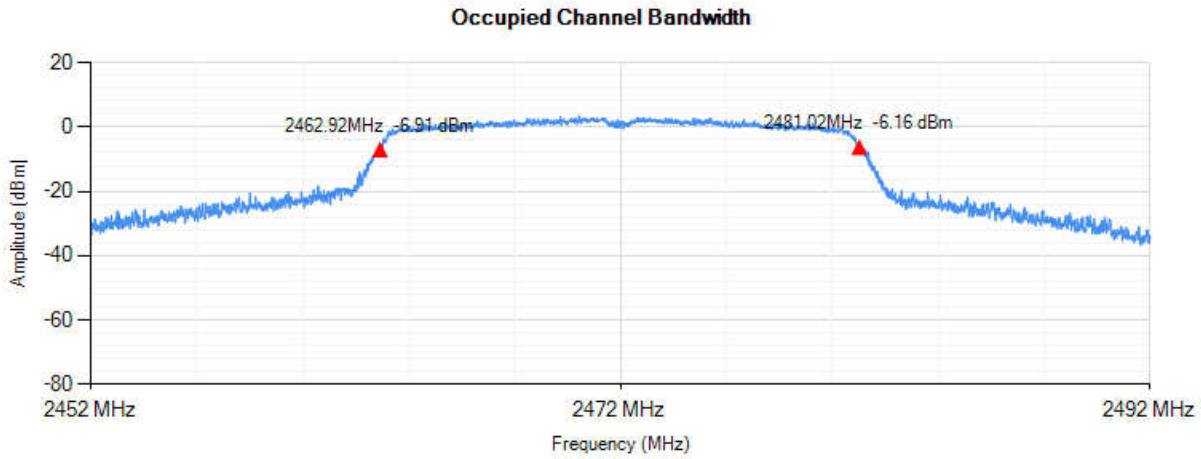
802.11g-High channel



802.11n-HT20-Low channel

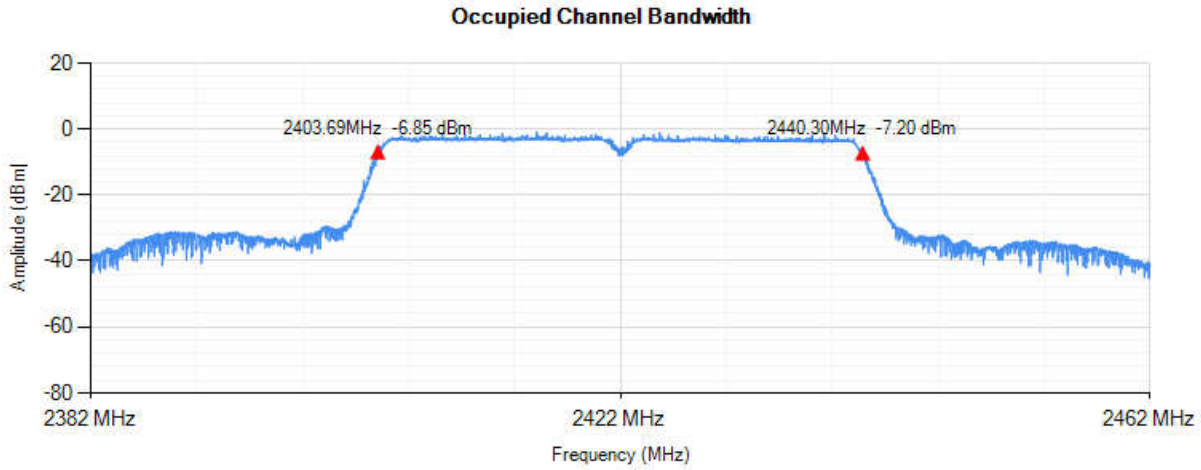


802.11n-HT20-High channel

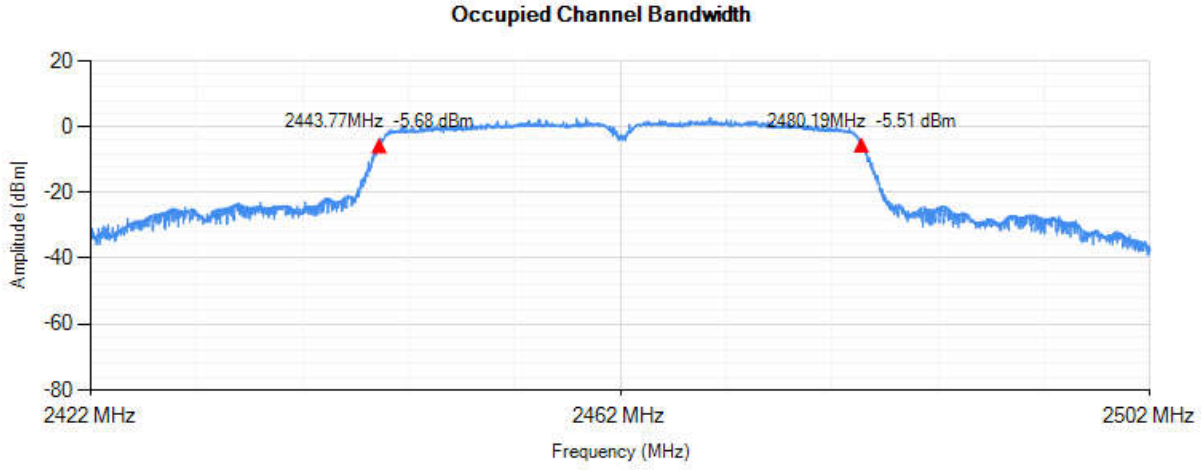


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802.11n-HT40-Low channel



802.11n-HT40-High channel



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10. TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN

10.1. Limit

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in figure 3.

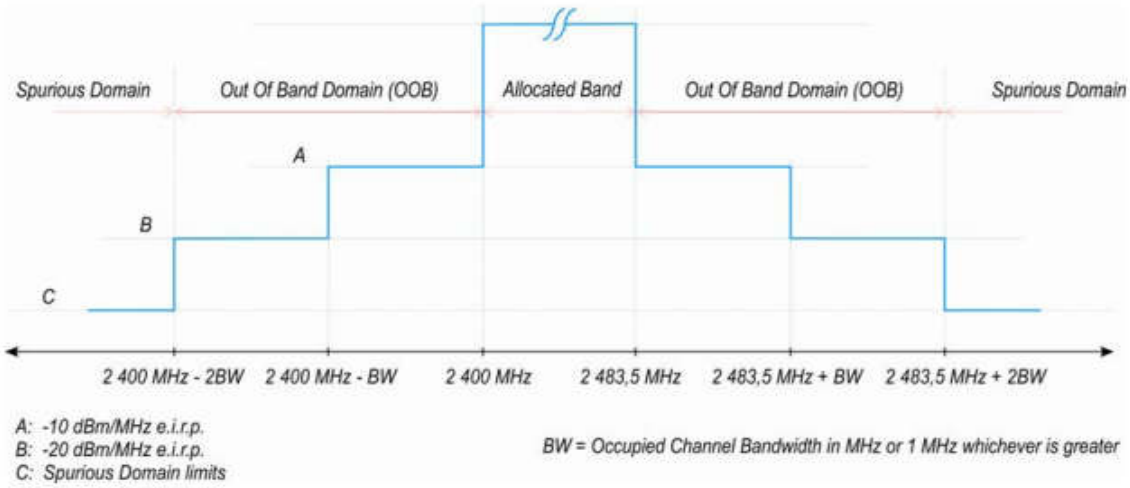
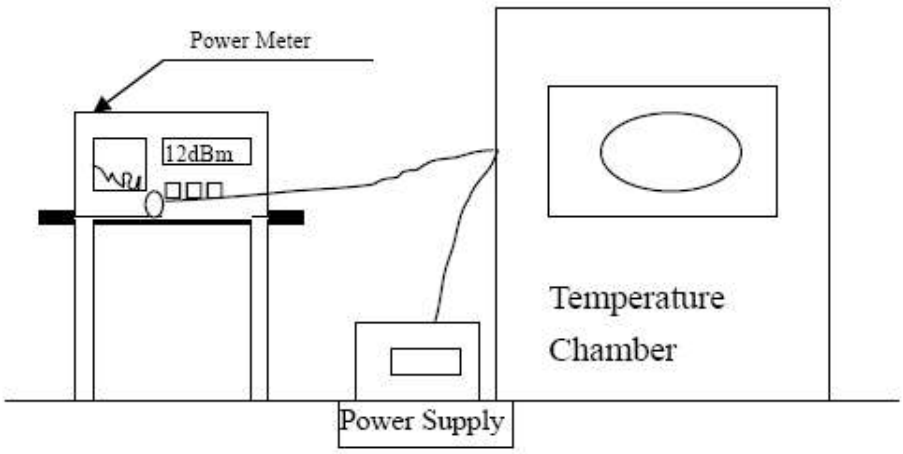


Figure 3: Transmit mask

10.2. Test Setup

For Conducted Measurement



10.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.9

Step 1:

• Connect the UUT to the spectrum analyser and use the following settings:
- Centre Frequency: 2 484 MHz
- Span: 0 Hz
- Resolution BW: 1 MHz
- Filter mode: Channel filter
- Video BW: 3 MHz
- Detector Mode: RMS
- Trace Mode: Clear / Write
- Sweep Mode: Continuous
- Sweep Points: Sweep Time [s] / (1 μs) or 5 000 whichever is greater
- Trigger Mode: Video trigger

NOTE 1: In case video triggering is not possible, an external trigger source may be used.

- Sweep Time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

Step 2: (segment 2 483,5 MHz to 2 483,5 MHz + BW)

• Adjust the trigger level to select the transmissions with the highest power level.

• For frequency hopping equipment operating in a normal hopping mode, the different hops will result in signal bursts with different power levels. In this case the burst with the highest power level shall be selected.

• Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function.

• Select RMS power to be measured within the selected window and note the result which is the RMS power within this 1 MHz segment (2 483,5 MHz to 2 484,5 MHz). Compare this value with the applicable limit provided by the mask.

• Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment within the range 2 483,5 MHz to 2 483,5 MHz + BW. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + BW - 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 3: (segment 2 483,5 MHz + BW to 2 483,5 MHz + 2BW)

• Change the centre frequency of the analyser to 2 484 MHz + BW and perform the measurement for the first 1 MHz segment within range 2 483,5 MHz + BW to 2 483,5 MHz + 2BW. Increase the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + 2 BW - 0,5 MHz.

Step 4: (segment 2 400 MHz - BW to 2 400 MHz)

• Change the centre frequency of the analyser to 2 399,5 MHz and perform the measurement for the first 1 MHz segment within range 2 400 MHz - BW to 2 400 MHz Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0,5 MHz.

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Step 5: (segment 2 400 MHz - 2BW to 2 400 MHz - BW)

• Change the centre frequency of the analyser to 2 399,5 MHz - BW and perform the measurement for the first 1 MHz segment within range 2 400 MHz - 2BW to 2 400 MHz - BW. Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0,5 MHz.

Step 6:

• In case of conducted measurements on equipment with a single transmit chain, the declared antenna assembly gain "G" in dBi shall be added to the results for each of the 1 MHz segments and compared with the limits provided by the mask given in figures 1 or 3. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered.

• In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the measurements need to be repeated for each of the active transmit chains. The declared antenna assembly gain "G" in dBi for a single antenna shall be added to these results. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered. Comparison with the applicable limits shall be done using any of the options given below:

- Option 1: the results for each of the transmit chains for the corresponding 1 MHz segments shall be added. The additional beamforming gain "Y" in dB shall be added as well and the resulting values compared with the limits provided by the mask given in figures 1 or 3.
- Option 2: the limits provided by the mask given in figures 1 or 3 shall be reduced by 10 x log10(Ach) and the additional beamforming gain "Y" in dB. The results for each of the transmit chains shall be individually compared with these reduced limits.

NOTE 2: Ach refers to the number of active transmit chains.

It shall be recorded whether the equipment complies with the mask provided in figures 1 or 3.

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10.4. Test Result

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Transmitter unwanted emissions in the out-of-band domain
Test Mode	:	Mode 1: Transmit by 802.11b

Frequency (MHz)	Test Conditions (℃)	Max measured Values (dBm/MHz)	Limit (dBm/MHz)
2400–2BW~ 2400-BW	25	-59.90	-20
2400–BW~2400	25	-40.01	-10
2483.5~ 2483.5+BW	25	-38.04	-10
2483.5+BW~ 2483.5+2BW	25	-60.17	-20

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Transmitter unwanted emissions in the out-of-band domain
Test Mode	:	Mode 2: Transmit by 802.11g

Frequency (MHz)	Test Conditions (℃)	Max measured Values (dBm/MHz)	Limit (dBm/MHz)
2400–2BW~ 2400-BW	25	-53.32	-20
2400–BW~2400	25	-39.71	-10
2483.5~ 2483.5+BW	25	-32.21	-10
2483.5+BW~ 2483.5+2BW	25	-57.62	-20

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Transmitter unwanted emissions in the out-of-band domain
Test Mode	:	Mode 3: Transmit by 802.11n(20MHz)

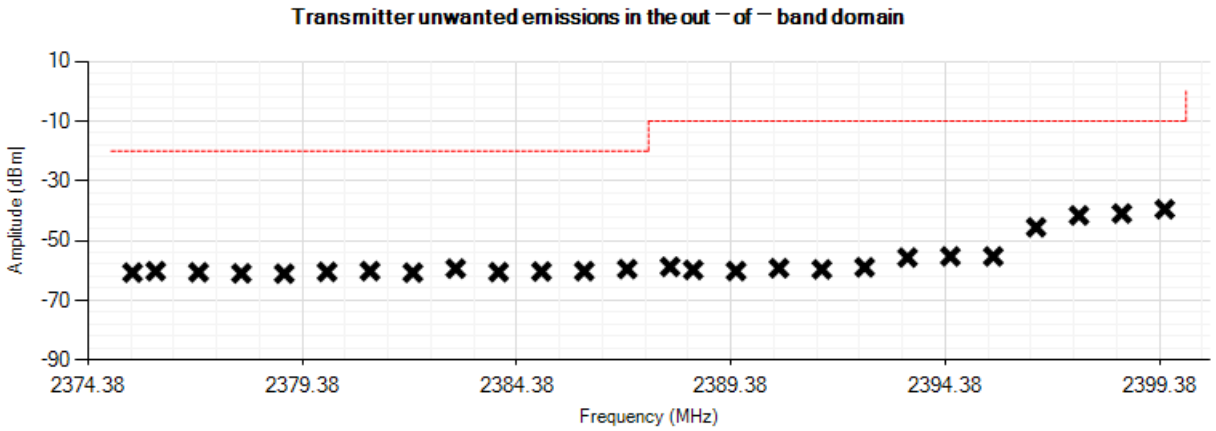
Frequency (MHz)	Test Conditions (℃)	Max measured Values (dBm/MHz)	Limit (dBm/MHz)
2400–2BW~ 2400-BW	25	-56.62	-20
2400–BW~2400	25	-38.85	-10
2483.5~ 2483.5+BW	25	-32.52	-10
2483.5+BW~ 2483.5+2BW	25	-57.40	-20

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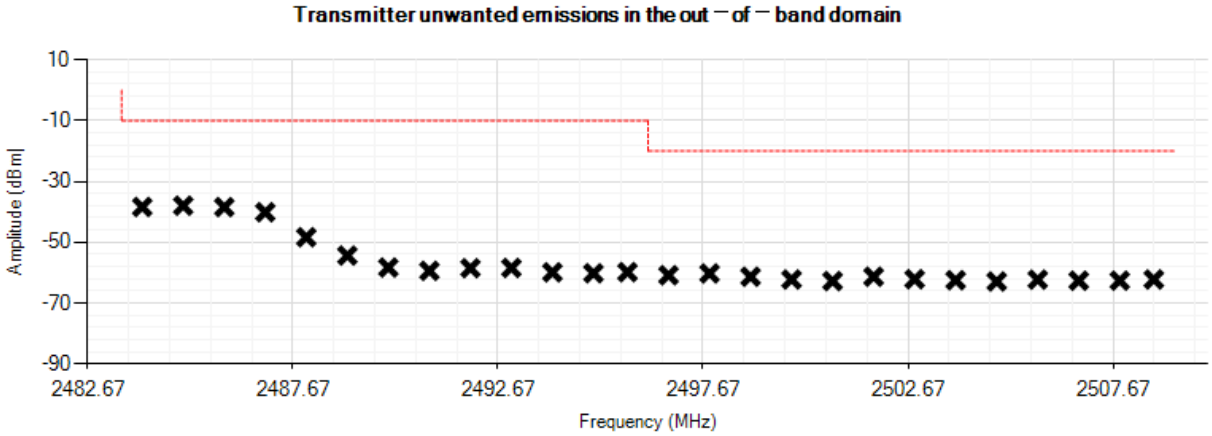
Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Transmitter unwanted emissions in the out-of-band domain
Test Mode	:	Mode 4: Transmit by 802.11n(40MHz)

Frequency (MHz)	Test Conditions (℃)	Max measured Values (dBm/MHz)	Limit (dBm/MHz)
2400–2BW~ 2400-BW	25	-59.90	-20
2400–BW~2400	25	-46.64	-10
2483.5~ 2483.5+BW	25	-38.10	-10
2483.5+BW~ 2483.5+2BW	25	-57.04	-20

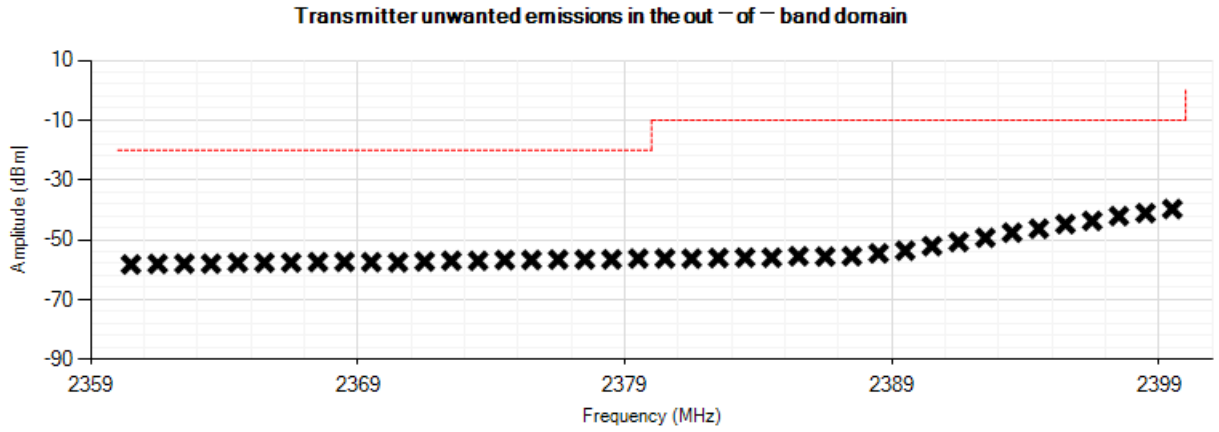
802.11b- Low channel



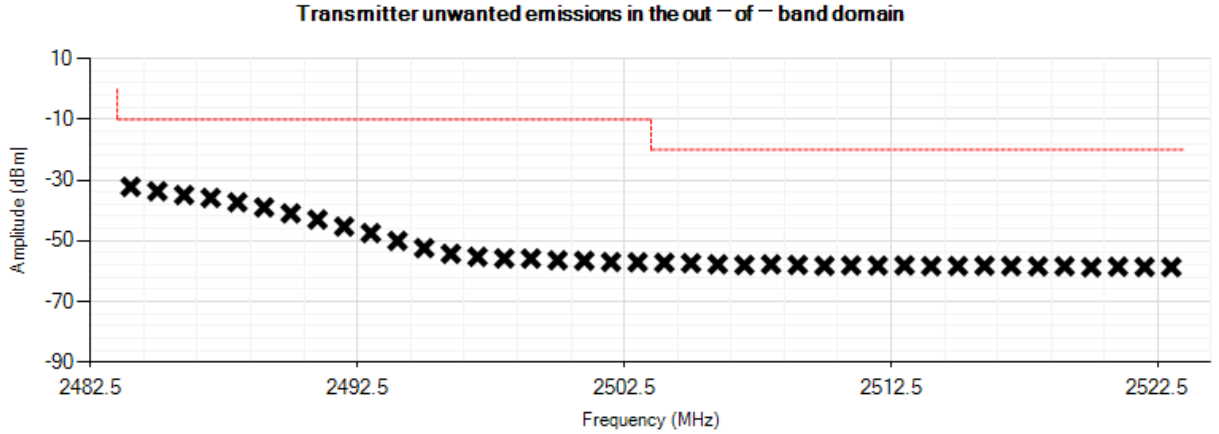
802.11b- High channel



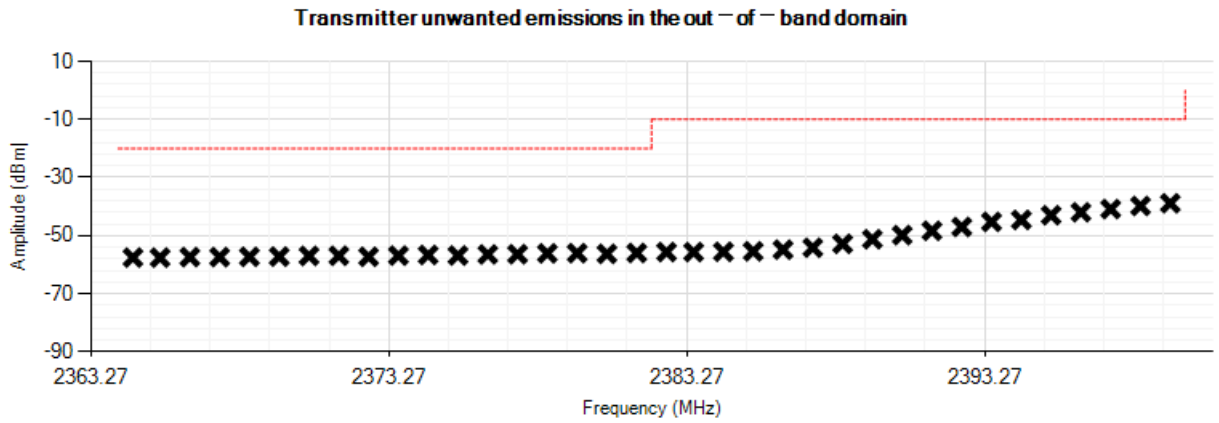
802.11g- Low channel



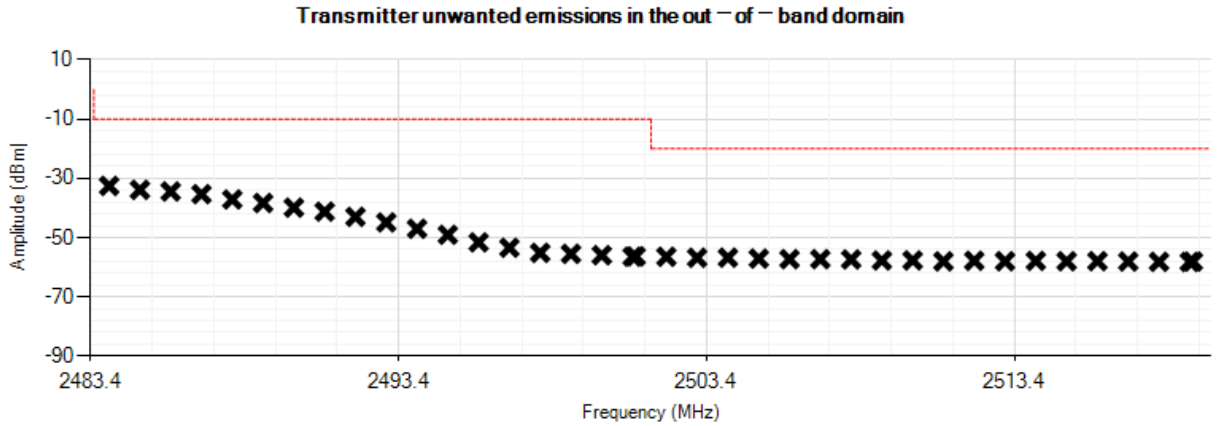
802.11g- High channel



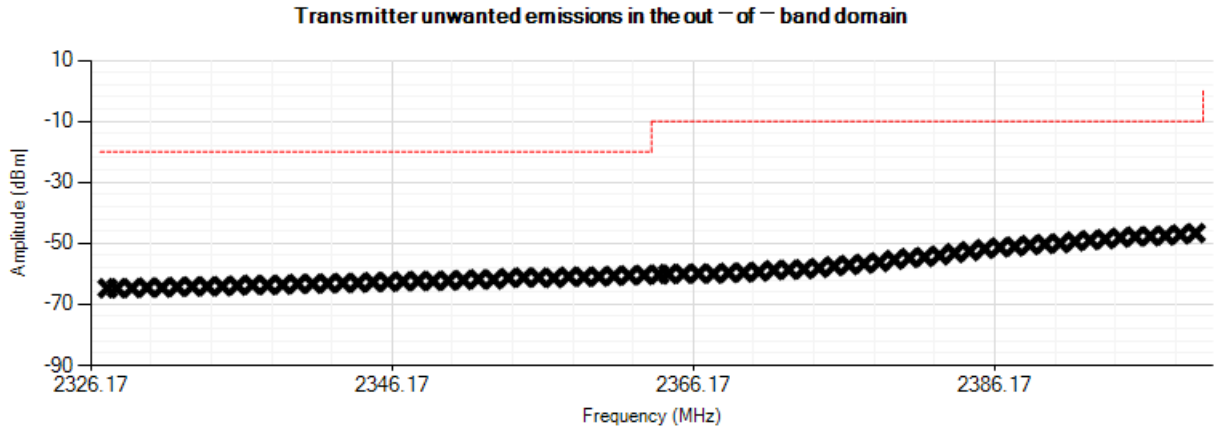
802.11n(HT20)- Low channel



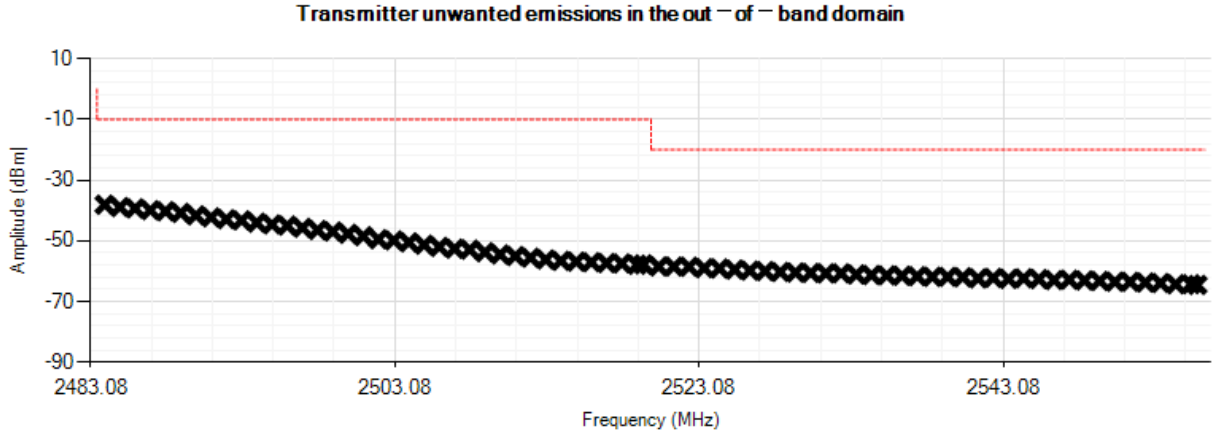
802.11n(HT20)- High channel



802.11n(HT40)- Low channel



802.11n(HT40)- High channel



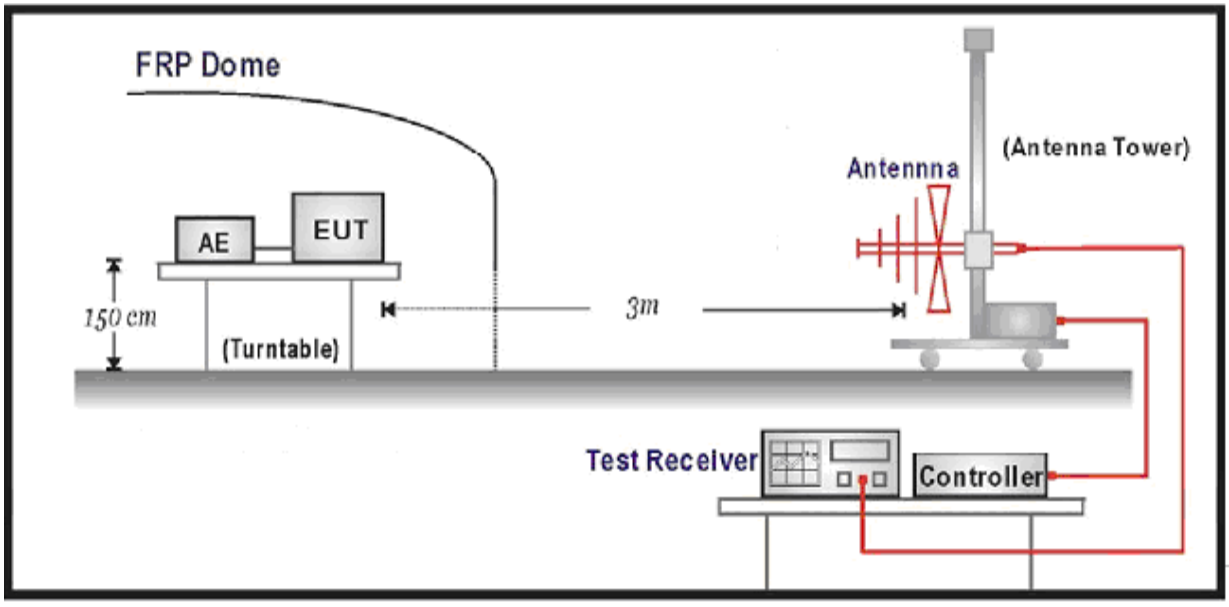
11. TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

11.1. Limit

Transmitter Limits for Spurious Emissions		
Frequency Range	Maximum power E.R.P. (≤ 1GHz) E.I.R.P. (> 1GHz)	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12,75 GHz	-30 dBm	1 MHz

11.2. Test Setup

For Radiated Measurement



11.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.10

Step 1:

The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in tables 1 or 4.

Step 2:

The emissions over the range 30 MHz to 1 000 MHz shall be identified.

Spectrum analyser settings:

• Resolution bandwidth: 100 kHz

• Video bandwidth: 300 kHz

• Detector mode: Peak

• Trace Mode: Max Hold

• Sweep Points: ≥ 19400

NOTE 1: For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.

• Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 100 kHz frequency step, the measurement time is greater than two transmissions of the UUT. For Frequency Hopping equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on the same hopping frequency in different hopping sequences. Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.3.10.2.1.3 and compared to the limits given in tables 1 or 4.

Step 3:

The emissions over the range 1 GHz to 12,75 GHz shall be identified.

Spectrum analyser settings:

• Resolution bandwidth: 1 MHz

• Video bandwidth: 3 MHz

• Detector mode: Peak

• Trace Mode: Max Hold

• Sweep Points: ≥ 23500

NOTE 2: For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.

• Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 1 MHz frequency step, the measurement time is greater than two transmissions of the UUT.

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11.4. Test Result

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Transmitter spurious emissions
Test Mode	:	Mode 1: Transmit by 802.11b(Radiated method)

Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 01 (2412MHz)					
107.13	H	-67.58	-54.00	-13.58	PK
219.27	V	-67.59	-54.00	-13.59	PK
813.37	H	-66.89	-54.00	-12.89	PK
945.33	V	-48.98	-36.00	-12.98	PK
4823.97	H	-43.03	-30.00	-13.03	PK
4824.03	V	-41.30	-30.00	-11.30	PK
7235.97	H	-41.01	-30.00	-11.01	PK
7235.99	V	-44.45	-30.00	-14.45	PK
Channel 13 (2472MHz)					
186.35	H	-64.05	-54.00	-10.05	PK
262.83	V	-49.31	-36.00	-13.31	PK
973.86	H	-46.70	-36.00	-10.70	PK
939.75	V	-48.87	-36.00	-12.87	PK
4943.99	H	-42.49	-30.00	-12.49	PK
4944.04	V	-40.61	-30.00	-10.61	PK
7415.99	H	-40.39	-30.00	-10.39	PK
7415.98	V	-42.16	-30.00	-12.16	PK

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Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Transmitter spurious emissions (Conducted Measurement)
Test Mode	:	Mode 1: Transmit by 802.11b

Frequency(MHz)	Measure Level(dBm)	Limit(dBm)	Margin(dB)	Detector
Channel 01 (2412MHz)				
265.39	-48.98	-36.00	-12.98	PK
938.57	-48.77	-36.00	-12.77	PK
4823.97	-40.56	-30.00	-10.56	PK
7235.99	-42.38	-30.00	-12.38	PK
Channel 13 (2472MHz)				
236.97	-50.41	-36.00	-14.41	PK
976.72	-47.44	-36.00	-11.44	PK
4943.97	-41.11	-30.00	-11.11	PK
7415.98	-42.71	-30.00	-12.71	PK

Note: only recorded the worst case data.

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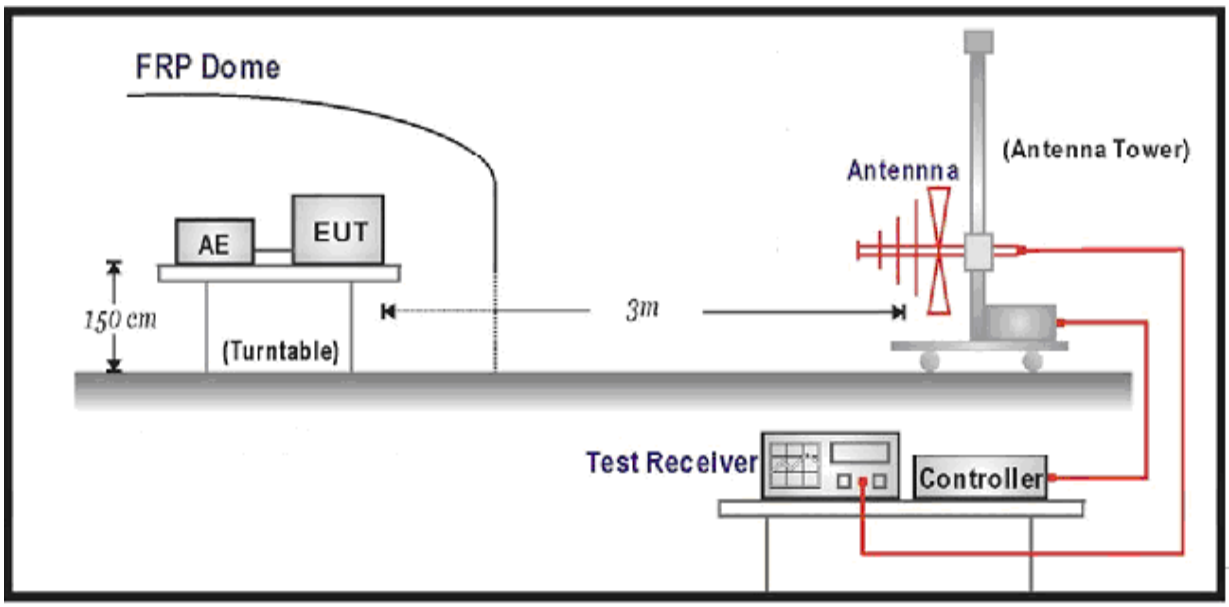
12. RECEIVER SPURIOUS EMISSIONS

12.1. Limit

Spurious emissions limits for receivers		
Frequency Range	Maximum power E.R.P. (≤ 1GHz) E.I.R.P. (> 1GHz)	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12.75 GHz	-47 dBm	1 MHz

12.2. Test Setup

For Radiated Measurement



12.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.11

Step 1:

The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in tables 2 or 5.

Step 2:

The emissions over the range 30 MHz to 1 000 MHz shall be identified.

Spectrum analyser settings:

• Resolution bandwidth: 100 kHz
• Video bandwidth: 300 kHz
• Detector mode: Peak
• Trace Mode: Max Hold
• Sweep Points: ≥ 19400
• Sweep time: Auto

Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.3.11.2.1.3 and compared to the limits given in tables 2 or 5.

Step 3:

The emissions over the range 1 GHz to 12,75 GHz shall be identified.

Spectrum analyser settings:

• Resolution bandwidth: 1 MHz
• Video bandwidth: 3 MHz
• Detector mode: Peak
• Trace Mode: Max Hold
• Sweep Points: ≥ 23500
• Sweep time: Auto

Allow the trace to stabilize. Any emissions identified during the sweeps above that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.3.11.2.1.3 and compared to the limits given in tables 2 or 5. Frequency Hopping equipment may generate a block (or several blocks) of spurious emissions anywhere within the spurious domain. If this is the case, only the highest peak of each block of emissions shall be measured using the procedure in clause 5.3.11.2.1.3.

Step 4:

• In case of conducted measurements on smart antenna systems (equipment with multiple receive chains), the steps 2 and 3 need to be repeated for each of the active receive chains (Ach).The limits used to identify emissions during this pre-scan need to be reduced with 10 × log10 (Ach) (number of active receive chains).

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12.4. Test Result

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Receiver spurious emissions
Test Mode	:	Mode 5: Receive by 802.11b(Radiated Measurement)

Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 01 (2412MHz)					
137.62	H	-68.99	-57.00	-11.99	PK
258.54	V	-70.78	-57.00	-13.78	PK
960.84	H	-70.52	-57.00	-13.52	PK
911.59	V	-67.19	-57.00	-10.19	PK
1326.63	H	-61.68	-47.00	-14.68	PK
1879.69	V	-59.16	-47.00	-12.16	PK
2396.29	H	-61.64	-47.00	-14.64	PK
2521.09	V	-58.74	-47.00	-11.74	PK
Channel 13 (2472MHz)					
191.25	H	-70.46	-57.00	-13.46	PK
149.39	V	-71.49	-57.00	-14.49	PK
981.69	H	-70.12	-57.00	-13.12	PK
919.72	V	-70.26	-57.00	-13.26	PK
1667.26	H	-57.25	-47.00	-10.25	PK
1384.44	V	-60.91	-47.00	-13.91	PK
2604.47	H	-57.65	-47.00	-10.65	PK
2888.65	V	-59.52	-47.00	-12.52	PK

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Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Receiver spurious emissions (Conducted Measurement)
Test Mode	:	Mode 5: Receive by 802.11b

Frequency(MHz)	Measure Level(dBm)	Limit(dBm)	Margin(dB)	Detector
Channel 01 (2412MHz)				
289.30	-70.68	-57.00	-13.68	PK
987.92	-71.46	-57.00	-14.46	PK
1862.85	-60.75	-47.00	-13.75	PK
2787.32	-61.67	-47.00	-14.67	PK
Channel 13 (2472MHz)				
102.62	-70.94	-57.00	-13.94	PK
843.29	-70.21	-57.00	-13.21	PK
1690.72	-58.30	-47.00	-11.30	PK
2371.85	-61.01	-47.00	-14.01	PK

Note: only recorded the worst case data.

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13. RECEIVER BLOCKING

13.1. Limit

Adaptive Frequency Hopping equipment shall comply with the requirements defined in clause 4.3.1.12.4

Table 6: Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-53	CW
P_{min} + 6 dB	2 300 2 330 2 360	-47	CW
P_{min} + 6 dB	2 523,5 2 553,5 2 583,5 2 613,5 2 643,5 2 673,5	-47	CW
NOTE 1: P_{min} is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Table 7: Receiver Blocking parameters receiver category 2 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-57	CW
P_{min} + 6 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

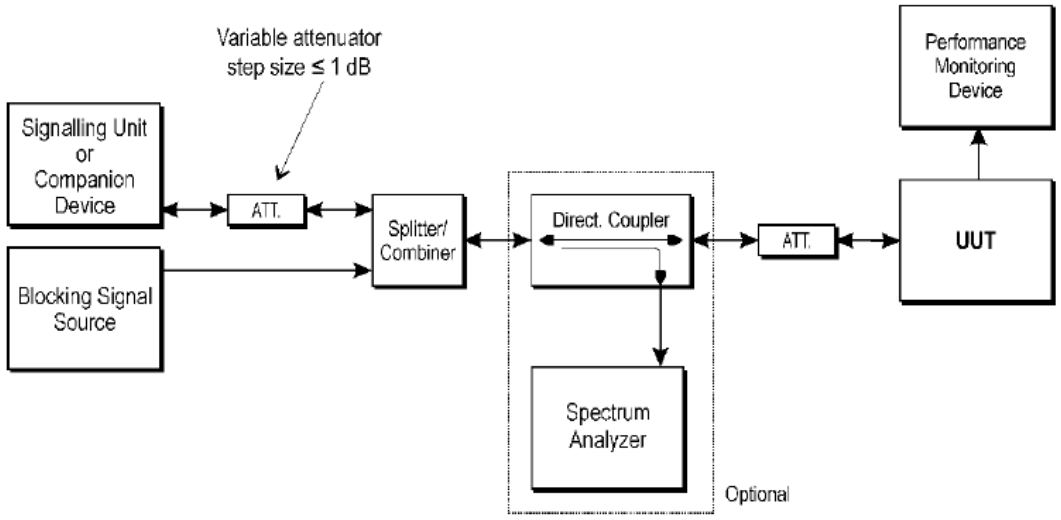
Table 8: Receiver Blocking parameters receiver category 3 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 12 dB	2 380 2 503,5	-57	CW
P_{min} + 12 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

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13.2. Test Setup

Conducted measurements



13.3. Test Procedure

Step 1:

• For non-frequency hopping equipment, the UUT shall be set to the lowest operating channel.

Step 2:

• The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding to the receiver category and type of equipment.

Step 3:

• With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup shown in figure 6. The attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still met. The resulting level for the wanted signal at the input of the UUT is Pmin.

• This signal level (Pmin) is increased by the value provided in the table corresponding to the receiver category and type of equipment.

Step 4:

• The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category and type of equipment. It shall be verified and recorded in the test report that the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is met.

Step 5:

• Repeat step 4 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment.

Step 6:

• For non-frequency hopping equipment, repeat step 2 to step 5 with the UUT operating at the highest operating channel.

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13.4. Test Result

Product	:	LTE GSM/WCDMA Smartphone
Test Item	:	Receiver spurious emissions(conducted)
Test Mode	:	Receiving
Test Environment	:	25℃ 43.5%RH

Wanted signal mean power from companion device (dBm)	Test mode	Test channel (MHz)	Blocking signal frequency (MHz)	Pmin	Blocking signal power (dBm)		Type of blocking signal	PER(%)		Test Result
					Test Value	Limit		Test Value	Limit	
Pmin + 6 dB	802.11b	2412	2380	-86	-35	≥-53	CW	3.60	10	Pass
			2503.5	-86	-26	≥-53	CW	5.00	10	Pass
			2300	-86	-25	≥-47	CW	3.67	10	Pass
			2330	-86	-24	≥-47	CW	4.58	10	Pass
			2360	-86	-16	≥-47	CW	3.21	10	Pass
			2523.5	-86	-27	≥-47	CW	3.05	10	Pass
			2553.5	-86	-24	≥-47	CW	3.33	10	Pass
			2583.5	-86	-23	≥-47	CW	4.22	10	Pass
			2613.5	-86	-15	≥-47	CW	4.05	10	Pass
			2643.5	-86	-18	≥-47	CW	4.45	10	Pass
			2673.5	-86	-13	≥-47	CW	3.75	10	Pass
		2472	2380	-88	-32	≥-53	CW	4.41	10	Pass
			2503.5	-88	-26	≥-53	CW	4.57	10	Pass
			2300	-88	-24	≥-47	CW	4.55	10	Pass
			2330	-88	-18	≥-47	CW	3.87	10	Pass
			2360	-88	-22	≥-47	CW	3.80	10	Pass
			2523.5	-88	-25	≥-47	CW	4.10	10	Pass
			2553.5	-88	-19	≥-47	CW	4.53	10	Pass
			2583.5	-88	-25	≥-47	CW	3.09	10	Pass
			2613.5	-88	-20	≥-47	CW	3.53	10	Pass
			2643.5	-88	-23	≥-47	CW	3.04	10	Pass
			2673.5	-88	-12	≥-47	CW	3.28	10	Pass
	802.11g	2412	2380	-86	-31	≥-53	CW	3.84	10	Pass
			2503.5	-86	-31	≥-53	CW	3.42	10	Pass
			2300	-86	-28	≥-47	CW	3.27	10	Pass
			2330	-86	-23	≥-47	CW	4.58	10	Pass
			2360	-86	-20	≥-47	CW	4.27	10	Pass
			2523.5	-86	-25	≥-47	CW	4.39	10	Pass
			2553.5	-86	-21	≥-47	CW	4.71	10	Pass
			2583.5	-86	-18	≥-47	CW	5.00	10	Pass
			2613.5	-86	-22	≥-47	CW	4.62	10	Pass

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			2643.5	-86	-18	≥-47	CW	4.00	10	Pass
			2673.5	-86	-20	≥-47	CW	3.92	10	Pass
		2472	2380	-87	-27	≥-53	CW	4.97	10	Pass
			2503.5	-87	-26	≥-53	CW	4.91	10	Pass
			2300	-87	-21	≥-47	CW	4.04	10	Pass
			2330	-87	-20	≥-47	CW	4.64	10	Pass
			2360	-87	-19	≥-47	CW	3.45	10	Pass
			2523.5	-87	-27	≥-47	CW	3.86	10	Pass
			2553.5	-87	-18	≥-47	CW	3.97	10	Pass
			2583.5	-87	-21	≥-47	CW	3.07	10	Pass
			2613.5	-87	-20	≥-47	CW	3.95	10	Pass
			2643.5	-87	-19	≥-47	CW	3.59	10	Pass
			2673.5	-87	-12	≥-47	CW	3.78	10	Pass
	802.11n 20	2412	2380	-87	-32	≥-53	CW	4.41	10	Pass
			2503.5	-87	-27	≥-53	CW	4.70	10	Pass
			2300	-87	-24	≥-47	CW	3.49	10	Pass
			2330	-87	-26	≥-47	CW	4.64	10	Pass
			2360	-87	-22	≥-47	CW	4.66	10	Pass
			2523.5	-87	-22	≥-47	CW	3.07	10	Pass
			2553.5	-87	-23	≥-47	CW	3.47	10	Pass
			2583.5	-87	-19	≥-47	CW	4.52	10	Pass
			2613.5	-87	-16	≥-47	CW	3.23	10	Pass
			2643.5	-87	-14	≥-47	CW	4.57	10	Pass
			2673.5	-87	-15	≥-47	CW	3.58	10	Pass
		2472	2380	-88	-33	≥-53	CW	4.02	10	Pass
			2503.5	-88	-24	≥-53	CW	3.40	10	Pass
			2300	-88	-19	≥-47	CW	4.01	10	Pass
			2330	-88	-17	≥-47	CW	3.10	10	Pass
			2360	-88	-17	≥-47	CW	3.43	10	Pass
			2523.5	-88	-22	≥-47	CW	4.68	10	Pass
			2553.5	-88	-18	≥-47	CW	3.03	10	Pass
			2583.5	-88	-21	≥-47	CW	4.25	10	Pass
			2613.5	-88	-21	≥-47	CW	4.97	10	Pass
			2643.5	-88	-18	≥-47	CW	4.04	10	Pass
			2673.5	-88	-20	≥-47	CW	4.91	10	Pass
	802.11n 40	2422	2380	-86	-29	≥-53	CW	4.01	10	Pass
			2503.5	-86	-26	≥-53	CW	3.61	10	Pass
			2300	-86	-18	≥-47	CW	3.79	10	Pass
			2330	-86	-26	≥-47	CW	4.59	10	Pass
			2360	-86	-18	≥-47	CW	4.75	10	Pass
			2523.5	-86	-21	≥-47	CW	3.37	10	Pass
			2553.5	-86	-22	≥-47	CW	3.05	10	Pass
			2583.5	-86	-23	≥-47	CW	4.50	10	Pass

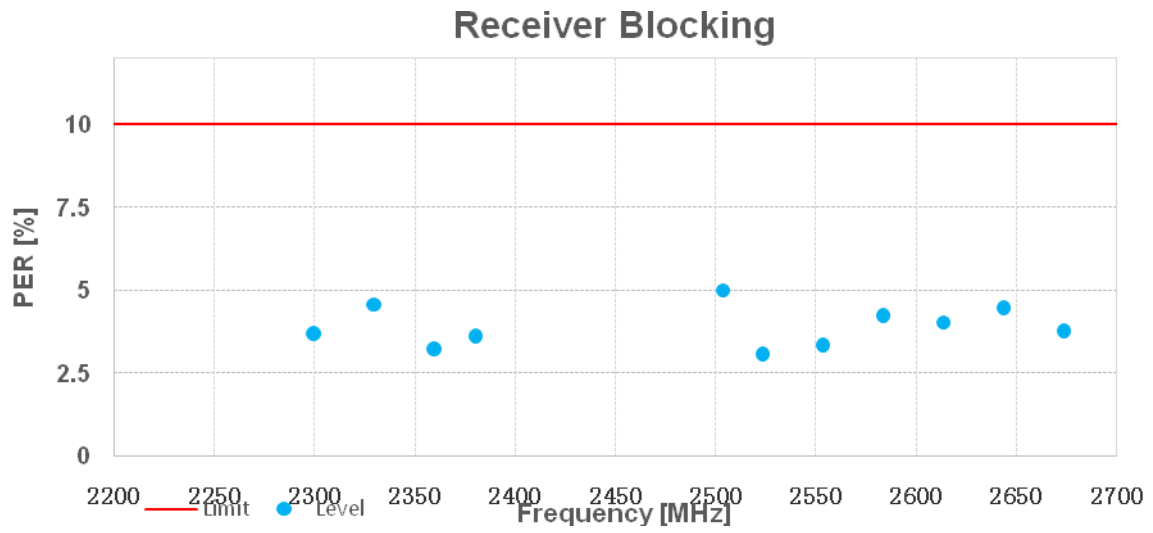
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			2613.5	-86	-20	≥-47	CW	4.06	10	Pass
			2643.5	-86	-18	≥-47	CW	4.86	10	Pass
			2673.5	-86	-17	≥-47	CW	3.63	10	Pass
		2462	2380	-87	-29	≥-53	CW	3.17	10	Pass
			2503.5	-87	-30	≥-53	CW	4.96	10	Pass
			2300	-87	-27	≥-47	CW	3.27	10	Pass
			2330	-87	-16	≥-47	CW	4.94	10	Pass
			2360	-87	-16	≥-47	CW	4.22	10	Pass
			2523.5	-87	-27	≥-47	CW	4.64	10	Pass
			2553.5	-87	-26	≥-47	CW	4.62	10	Pass
			2583.5	-87	-23	≥-47	CW	3.51	10	Pass
			2613.5	-87	-18	≥-47	CW	3.74	10	Pass
			2643.5	-87	-19	≥-47	CW	3.21	10	Pass
			2673.5	-87	-13	≥-47	CW	3.35	10	Pass

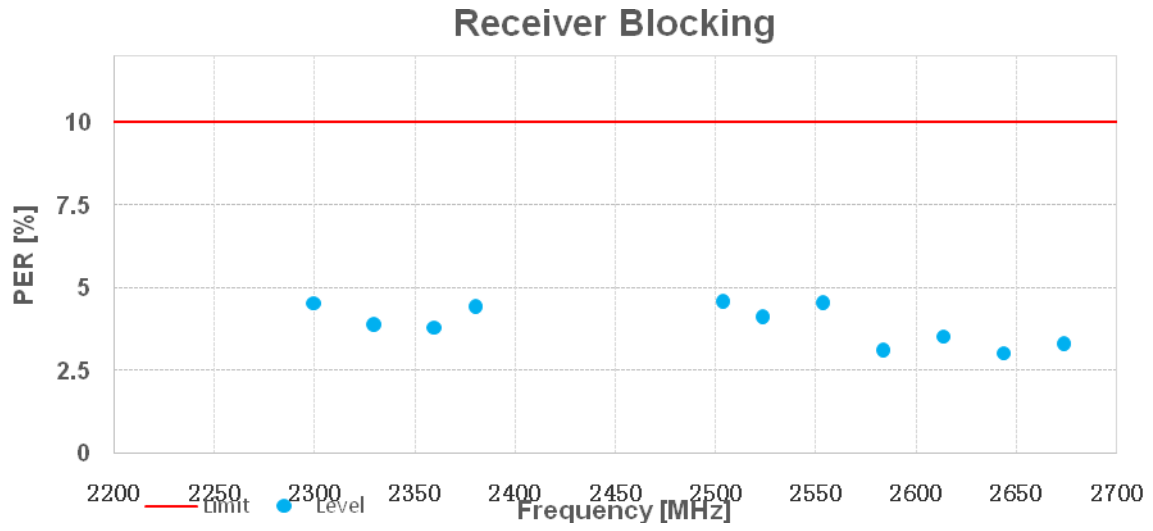
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TEST PLOT

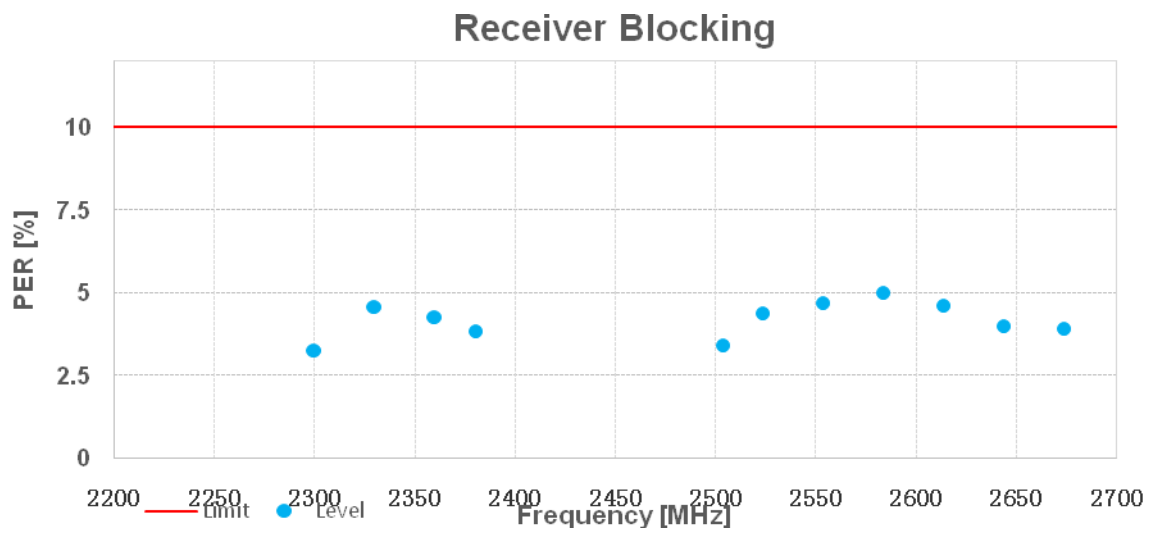
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Receiver Blocking_802.11b_2472

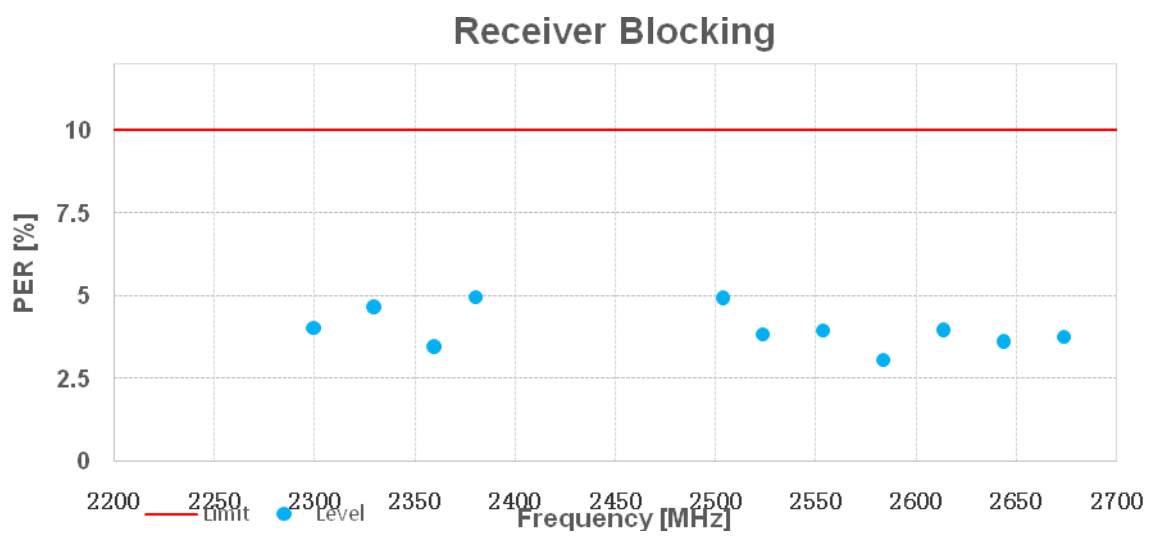


Receiver Blocking_802.11g_2412

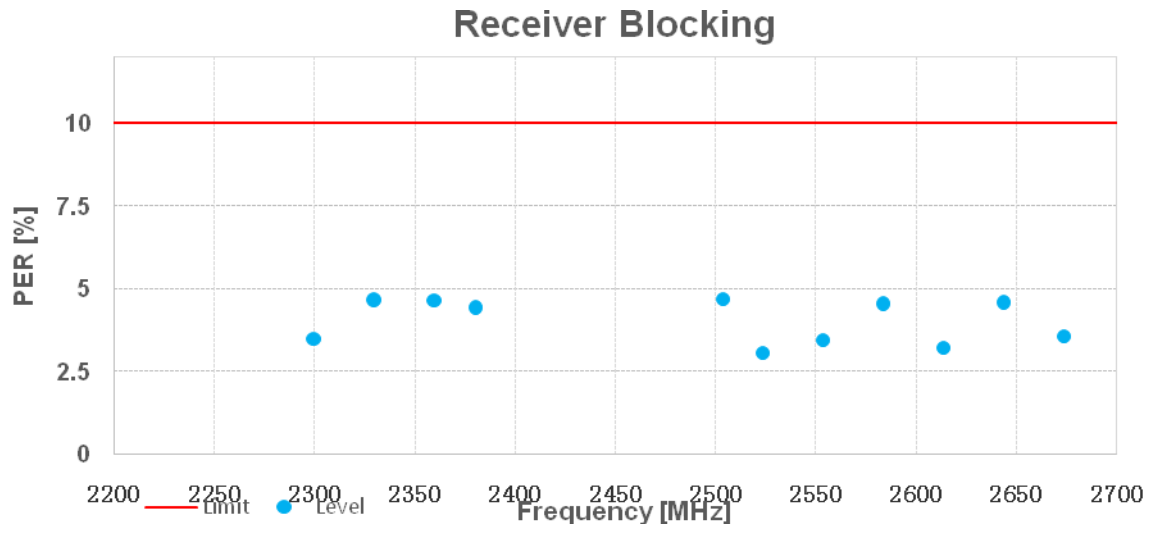


Receiver Blocking_802.11g_2472

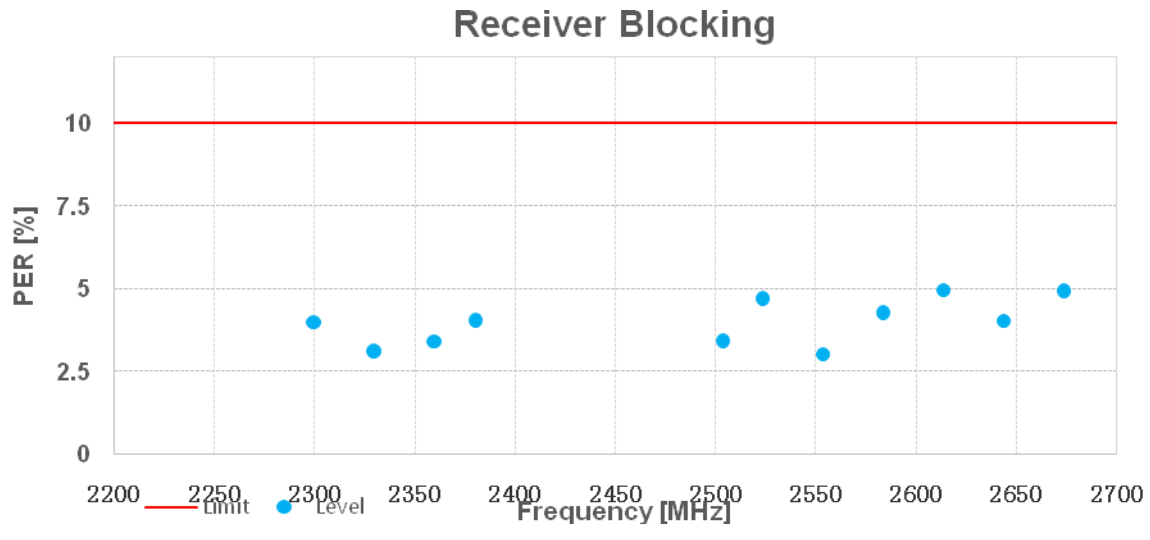
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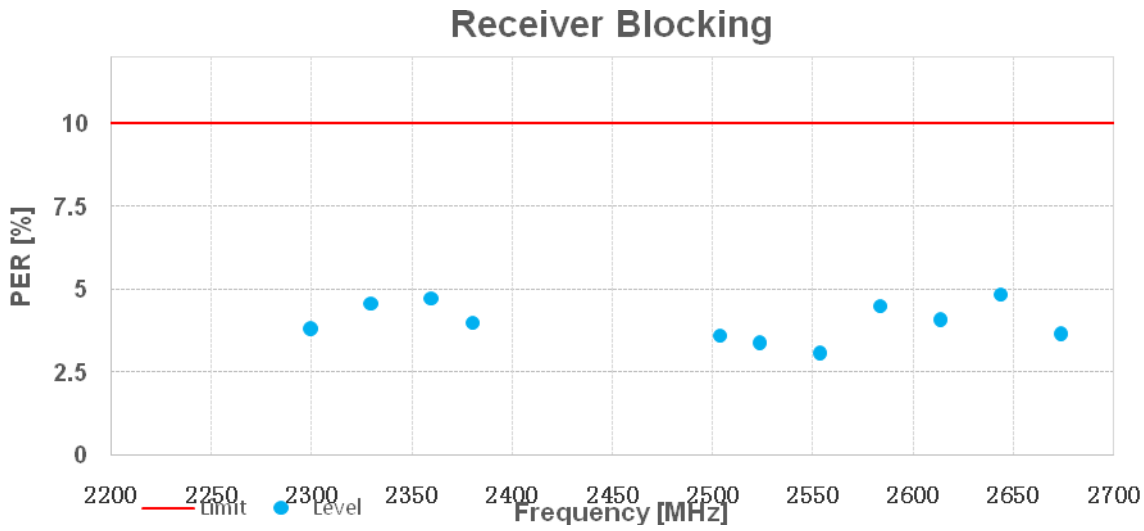
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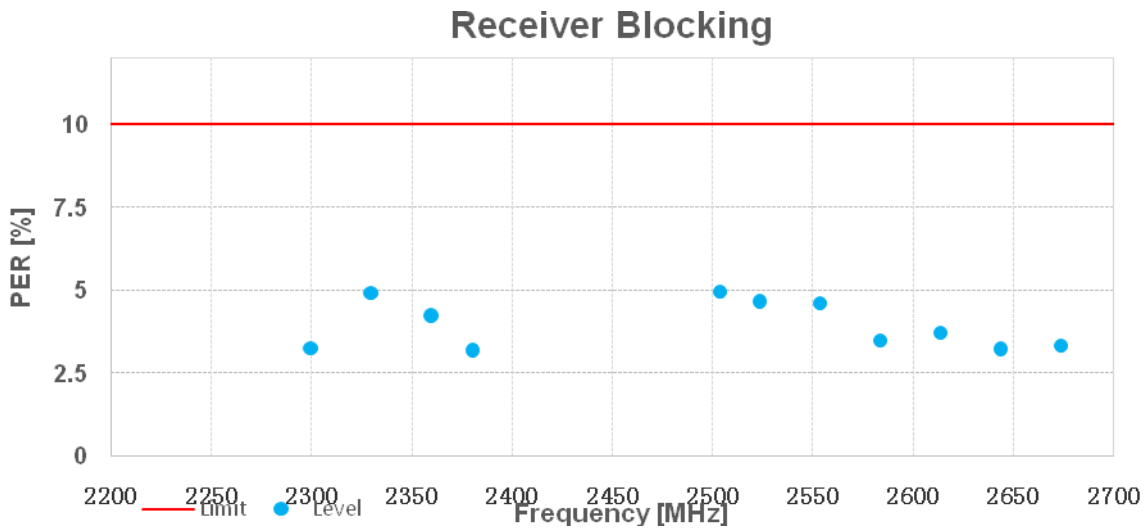
Receiver Blocking_802.11n20_2472



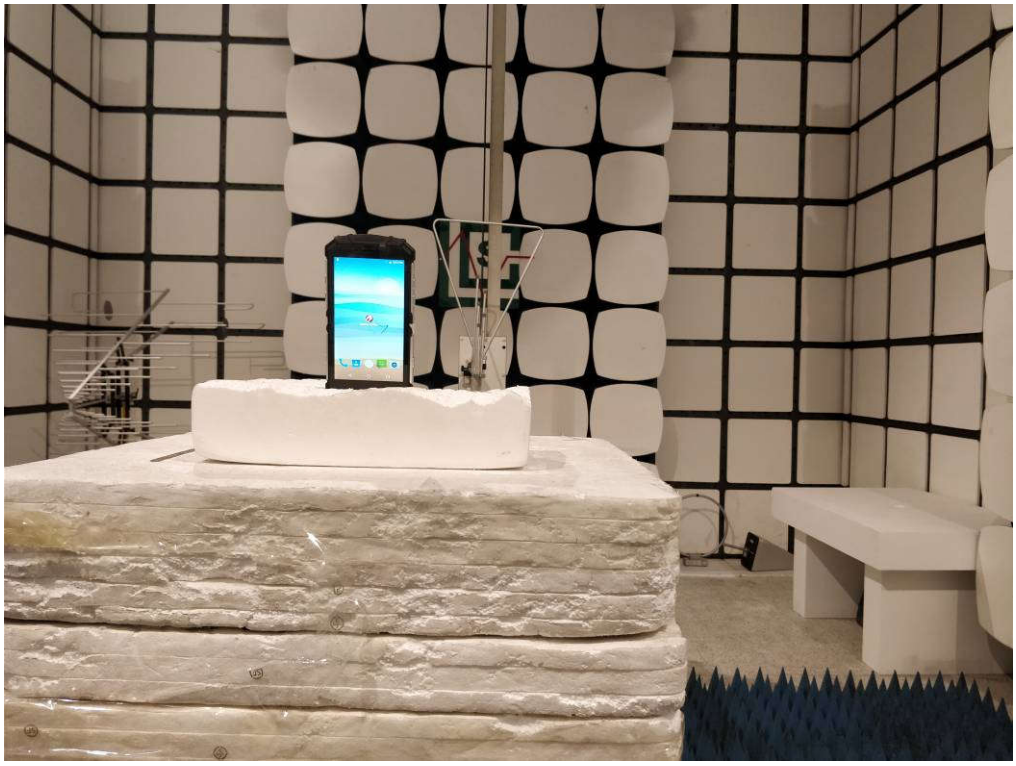
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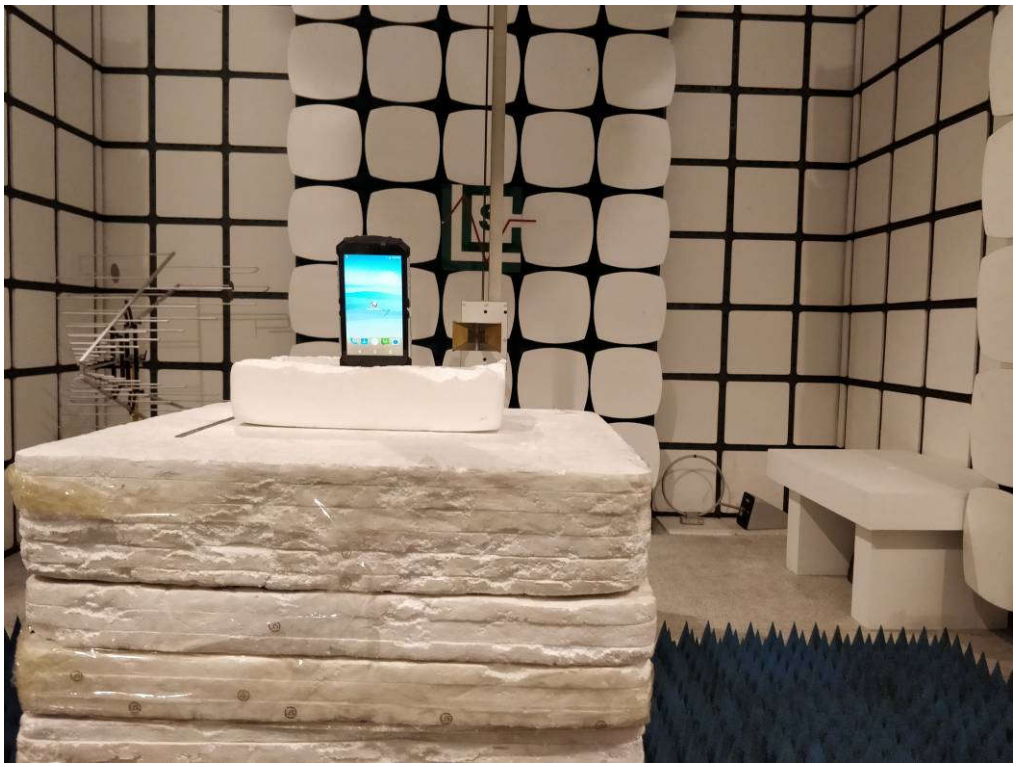
Receiver Blocking_802.11n40_2462



14. PHOTOGRAPHS OF TEST SETUP



Spurious Emission below 1GHz



Spurious Emission above 1GHz

----------THE END OF REPORT----------

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