



FCC

RF Test Report

Product Name: Smart Phone

Model Number: H1511

Report No: SYBH(Z-RF)011072015-2001

FCC ID: QISH1511

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Notice

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7. The test report is only valid for the test samples.
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Applicant: Huawei Technologies Co., Ltd.
Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd.,
 Bantian, Longgang District, Shenzhen, 518129, P.R.C

Date of Receipt Sample: 2015-07-20
Start Date of Test: 2015-07-20
End Date of Test: 2015-09-08

Test Result: Pass

| | | | |
|-------------------------------------|------------|-------------|---|
| Approved by Senior Engineer: | 2015-09-10 | Liu Chunlin |  |
| | Date | Name | Signature |

| | | | |
|---------------------|------------|----------|---|
| Prepared by: | 2015-09-10 | maowenli |  |
| | Date | Name | Signature |



Modification Record

| No. | Last Report No. | Modification Description |
|-----|-----------------|--------------------------|
| 1 | | First report. |
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2 Test Summary

2.1 Cellular Band (824-849 MHz paired with 869-894 MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict |
|--|---------------------|--|-------------|---------|
| Effective (Isotropic) Radiated Power Output Data | §2.1046, §22.913 | FCC: ERP ≤ 7 W. IC: EIRP ≤ 11.5 W. | Appendix A | Pass |
| Peak-Average Ratio | --- | IC: Limit≤13 dB | Appendix B | Pass |
| Modulation Characteristics | §2.1047 | Digital modulation | Appendix C | Pass |
| Bandwidth | §2.1049 | OBW: No limit. EBW: No limit. | Appendix D | Pass |
| Band Edges Compliance | §2.1051, §22.917 | ≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. | Appendix E | Pass |
| Spurious Emission at Antenna Terminals | §2.1051, §22.917 | FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. IC: ≤ -13 dBm/100 kHz (for EBW ≤ 4 MHz) or ≤ -13 dBm/1 MHz (for EBW > 4 MHz), from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. | Appendix F | Pass |
| Field Strength of Spurious Radiation | §2.1053, §22.917 | FCC: ≤ -13 dBm/100 kHz. IC: ≤ -13 dBm/100 kHz (for EBW ≤ 4 MHz) or ≤ -13 dBm/1 MHz (for EBW > 4 MHz). | Appendix G | Pass |
| Frequency Stability | §2.1055, §22.355 | ≤ ±2.5ppm. | Appendix H | Pass |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested". | | | | |

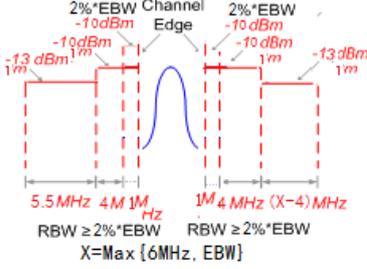
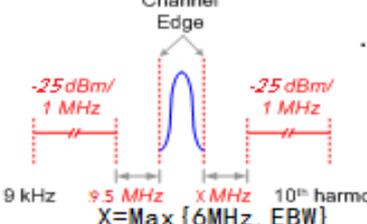
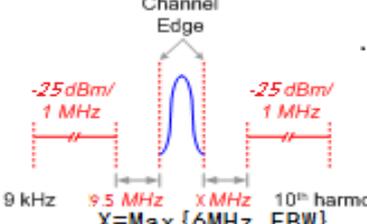
2.2 PCS Band (1850-1910 MHz paired with 1930-1990 MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict |
|--|---------------------|--|-------------|---------|
| Effective (Isotropic) Radiated Power Output Data | §2.1046, §24.232 | $EIRP \leq 2\text{ W}$ | Appendix A | Pass |
| Peak-Average Ratio | §2.1046, §24.232 | FCC: Limit $\leq 13\text{ dB}$ | Appendix B | Pass |
| Modulation Characteristics | §2.1047 | Digital modulation | Appendix C | Pass |
| Bandwidth | §2.1049 | OBW: No limit. EBW: No limit. | Appendix D | Pass |
| Band Edges Compliance | §2.1051, §24.238 | $\leq -13\text{ dBm}/1\%*EBW$, in 1 MHz bands immediately outside and adjacent to the frequency block. | Appendix E | Pass |
| Spurious Emission at Antenna Terminals | §2.1051, §24.238 | $\leq -13\text{ dBm}/1\text{ MHz}$, from 9 kHz to 10^{th} harmonics but outside authorized operating frequency ranges. | Appendix F | Pass |
| Field Strength of Spurious Radiation | §2.1053, §24.238 | $\leq -13\text{ dBm}/1\text{ MHz}$. | Appendix G | Pass |
| Frequency Stability | §2.1055, §24.235 | FCC: within authorized frequency block. IC: $\leq \pm 2.5\text{ ppm}$. | Appendix H | Pass |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested". | | | | |

2.3 AWS Band (1710-1755 MHz paired with 2110-2155 MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict |
|--|--------------------|--|-------------|---------|
| Effective (Isotropic) Radiated Power Output Data | §2.1046, §27.50(d) | $EIRP \leq 1\text{ W}$ | Appendix A | Pass |
| Peak-Average Ratio | §2.1046, §27.50(d) | FCC: Limits $\leq 13\text{ dB}$ | Appendix B | Pass |
| Modulation Characteristics | §2.1047 | Digital modulation | Appendix C | Pass |
| Bandwidth | §2.1049 | OBW: No limit. EBW: No limit. | Appendix D | Pass |
| Band Edges Compliance | §2.1051, §27.53(h) | $\leq -13\text{ dBm}/1\%*EBW$, in 1 MHz bands immediately outside and adjacent to the frequency block. | Appendix E | Pass |
| Spurious Emission at Antenna Terminals | §2.1051, §27.53(h) | $\leq -13\text{ dBm}/1\text{ MHz}$, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. | Appendix F | Pass |
| Field Strength of Spurious Radiation | §2.1053, §27.53(h) | $\leq -13\text{ dBm}/1\text{ MHz}$. | Appendix G | Pass |
| Frequency Stability | §2.1055, §27.54 | Within authorized bands of operation/frequency block. | Appendix H | Pass |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested". | | | | |

2.4 BRS&EBS Band7 (2500-2570 MHz paired with 2620-2690 MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict |
|--|--------------------|---|-------------|---------|
| Effective (Isotropic) Radiated Power Output Data | §2.1046, §27.50(h) | EIRP \leq 2W | Appendix A | Pass |
| Peak-Average Ratio | --- | --- | Appendix B | N/T |
| Modulation Characteristics | §2.1047 | Digital modulation | Appendix C | Pass |
| Bandwidth | §2.1049 | OBW: No limit. EBW: No limit. | Appendix D | Pass |
| Band Edges Compliance | §2.1051, §27.53(m) | FCC:  | Appendix E | Pass |
| Spurious Emission at Antenna Terminals | §2.1051, §27.53(m) |  | Appendix F | Pass |
| Field Strength of Spurious Radiation | §2.1053, §27.53(m) |  | Appendix G | Pass |
| Frequency Stability | §2.1055, §27.54 | Within authorized bands of operation/frequency block. | Appendix H | Pass |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested". | | | | |

2.5 BRS&EBS Band41 (2496-2690 MHz paired with 2496-2690 MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict |
|--|--------------------|---|-------------|---------|
| Effective (Isotropic) Radiated Power Output Data | §2.1046, §27.50(h) | EIRP ≤ 2W | Appendix A | Pass |
| Peak-Average Ratio | --- | --- | Appendix B | N/T |
| Modulation Characteristics | §2.1047 | Digital modulation | Appendix C | Pass |
| Bandwidth | §2.1049 | OBW: No limit. EBW: No limit. | Appendix D | Pass |
| Band Edges Compliance | §2.1051, §27.53(m) | FCC: | Appendix E | Pass |
| Spurious Emission at Antenna Terminals | §2.1051, §27.53(m) | | Appendix F | Pass |
| Field Strength of Spurious Radiation | §2.1053, §27.53(m) | | Appendix G | Pass |
| Frequency Stability | §2.1055, §27.54 | Within authorized bands of operation/frequency block. | Appendix H | Pass |

NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".

2.6 Band12 (699-716MHz paired with 729-746 MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict |
|--|-----------------------|--|-------------|---------|
| Effective (Isotropic) Radiated Power Output Data | FCC Rule No. | FCC: ERP \leq 3 W. 698-716MHz (block A-, B-, C-) :Average EIRP Power \leq 50 W. PAPR \leq 13 dB@0.1%. | Appendix A | Pass |
| Peak-Average Ratio | §2.1046, §27.50(c) | --- | Appendix B | Pass |
| Modulation Characteristics | --- | Digital modulation | Appendix C | Pass |
| Bandwidth | §2.1047 | OBW: No limit. EBW: No limit. | Appendix D | Pass |
| Band Edges Compliance | §2.1049, | \leq -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. | Appendix E | Pass |
| Spurious Emission at Antenna Terminals | §2.1051, §27.53(g) | FCC: \leq -13 dBm/100 kHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. | Appendix F | Pass |
| Field Strength of Spurious Radiation | §2.1051, §27.53(g) | FCC: \leq -13 dBm/100 kHz. | Appendix G | Pass |
| Frequency Stability | §2.1053, §27.53(g) | \leq \pm 2.5ppm. | Appendix H | Pass |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested". | | | | |

2.7 Band13 (777-787MHz paired with 746-756 MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict (NOTE 1) |
|--|--------------------|---|-------------|------------------|
| Effective (Isotropic) Radiated Power Output Data | §2.1046, §27.50(b) | FCC: ERP ≤ 3 W. | Appendix A | Pass |
| Peak-Average Ratio | --- | --- | Appendix B | N/T |
| Modulation Characteristics | §2.1047 | Digital modulation | Appendix C | Pass |
| Bandwidth | §2.1049, | OBW: No limit. EBW: No limit. | Appendix D | Pass |
| Band Edges Compliance | §2.1051, §27.53(c) | ≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. | Appendix E | Pass |
| Spurious Emission at Antenna Terminals | §2.1051, §27.53(c) | FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations. | Appendix F | Pass |
| Field Strength of Spurious Radiation | §2.1053, §27.53(c) | FCC: ≤ -13 dBm/100 kHz. | Appendix G | Pass |
| Frequency Stability | §2.1055, §27.54 | Within authorized bands of operation/frequency block. | Appendix H | Pass |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested". | | | | |

2.8 Band17 (704-716MHz paired with 734-746 MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict |
|--|-----------------------|--|-------------|---------|
| Effective (Isotropic) Radiated Power Output Data | FCC Rule No. | FCC: ERP \leq 3 W. 698-716MHz (block A-, B-, C-) :Average EIRP Power \leq 50 W. PAPR \leq 13 dB@0.1%. | Appendix A | Pass |
| Peak-Average Ratio | §2.1046, §27.50(c) | --- | Appendix B | Pass |
| Modulation Characteristics | --- | Digital modulation | Appendix C | Pass |
| Bandwidth | §2.1047 | OBW: No limit. EBW: No limit. | Appendix D | Pass |
| Band Edges Compliance | §2.1049, | \leq -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. | Appendix E | Pass |
| Spurious Emission at Antenna Terminals | §2.1051, §27.53(g) | FCC: \leq -13 dBm/100 kHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. | Appendix F | Pass |
| Field Strength of Spurious Radiation | §2.1051, §27.53(g) | FCC: \leq -13 dBm/100 kHz. | Appendix G | Pass |
| Frequency Stability | §2.1053, §27.53(g) | \leq \pm 2.5ppm. | Appendix H | Pass |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested". | | | | |

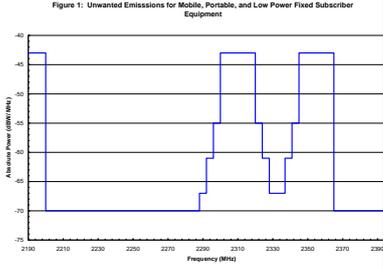
2.9 Band26 lower (814-824 MHz paired with 859-869MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict |
|--|------------------|--|-------------|---------|
| Transmitter Conducted Power Output | §2.1046, §90.635 | < 100 W. | Appendix A | PASS |
| Peak-Average Ratio | --- | --- | Appendix B | N/T |
| Modulation Characteristics | §2.1047 | Digital modulation | Appendix C | PASS |
| Bandwidth | §2.1049 | OBW: No limit. EBW: No limit. | Appendix D | PASS |
| Band Edges Compliance | §2.1051, §90.691 | < 50 + 10Log10(P[Watts]) at Band Edge and for all out-of-band emissions w/in 37.5kHz of Block Edge | Appendix E | PASS |
| Spurious Emission at Antenna Terminals | §2.1051, §90.691 | < 43 + 10Log10(P[Watts]) for all out-of-band emissions | Appendix F | PASS |
| Field Strength of Spurious Radiation | §2.1053, §90.691 | < 43 + 10Log10(P[Watts]) for all out-of-band emissions | Appendix G | PASS |
| Frequency Stability | §2.1055, §90.213 | < ±2.5ppm. | Appendix H | PASS |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested". | | | | |

2.10 Band25 (1850-1915 MHz paired with 1930-1995MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict |
|--|------------------|--|-------------|---------|
| Effective (Isotropic) Radiated Power Output Data | §2.1046, §24.232 | $EIRP \leq 2\text{ W}$ | Appendix A | PASS |
| Peak-Average Ratio | §2.1046, §24.232 | FCC: $Limit \leq 13\text{ dB}$ | Appendix B | PASS |
| Modulation Characteristics | §2.1047 | Digital modulation | Appendix C | PASS |
| Bandwidth | §2.1049 | OBW: No limit. EBW: No limit. | Appendix D | PASS |
| Band Edges Compliance | §2.1051, §24.238 | $\leq -13\text{ dBm}/1\%*EBW$, in 1 MHz bands immediately outside and adjacent to the frequency block. | Appendix E | PASS |
| Spurious Emission at Antenna Terminals | §2.1051, §24.238 | $\leq -13\text{ dBm}/1\text{ MHz}$, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. | Appendix F | PASS |
| Field Strength of Spurious Radiation | §2.1053, §24.238 | $\leq -13\text{ dBm}/1\text{ MHz}$. | Appendix G | PASS |
| Frequency Stability | §2.1055, §24.235 | FCC: within authorized frequency block. IC: $\leq \pm 2.5\text{ ppm}$. | Appendix H | PASS |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested". | | | | |

2.11 WCS Band (2305-2315 MHz paired with 2350-2360 MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict |
|--|-------------------------------|---|-------------|---------|
| Effective (Isotropic) Radiated Power Output Data | §2.1046, §27.50(a), §27.53(a) | EIRP PD ≤ 20 W/5 MHz (for 2305-2320MHz, 2345-2360MHz). | Appendix A | Pass |
| Peak-Average Ratio | §2.1046, | Limit≤13 dB | Appendix B | Pass |
| Modulation Characteristics | §2.1047 | Digital modulation | Appendix C | Pass |
| Bandwidth | §2.1049, §27.53(a) | OBW: No limit. EBW: No limit. | Appendix D | Pass |
| Band Edges Compliance | §2.1051, §27.53(a) | ≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. | Appendix E | Pass |
| Spurious Emission at Antenna Terminals | §2.1051, §27.53(a) |  | Appendix F | Pass |
| Field Strength of Spurious Radiation | §2.1053, §27.53(a) | ≤ -13 dBm/1 MHz. | Appendix G | Pass |
| Frequency Stability | §2.1055, §27.54 | within the range of the operating frequency blocks | Appendix H | Pass |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested". | | | | |



2.12 Band 10 (816-824 MHz paired with 861-869 MHz)

| Test Item | FCC Rule No. | Requirements | Test Result | Verdict (NOTE 2) |
|--|--------------------------|---|-------------|------------------|
| Transmit Output Power Data | §2.1046, §90.205 §90.635 | ERP ≤ 100W | Appendix A | Pass |
| Peak-Average Ratio | --- | --- | Appendix B | N/T |
| Modulation Characteristics | §2.1047 | Not applicable | Appendix C | Pass |
| Bandwidth | §2.1049, §90.209 | Upper /lower frequency limits :0.5% of the mean power | Appendix D | Pass |
| Band Edges Compliance | §2.1051, §90.210 | ≤ -13 dBm | Appendix E | Pass |
| Spurious Emission at Antenna Terminals | §2.1051, §90.210 §90.669 | ≤ -13 dBm | Appendix F | Pass |
| Field Strength of Spurious Radiation | §2.1053, §90.210 | -13 dBm | Appendix G | Pass |
| Frequency Stability | §2.1055, §90.213 | ≤ ±2.5ppm. | Appendix H | Pass |
| NOTE 1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested". | | | | |



3 Description of the Equipment under Test (EUT)

3.1 General Description

H1511 is subscriber equipment in the LTE/WCDMA/CDMA/GSM system. The GSM/GPRS/EDGE frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900. The HSPA+/UMTS frequency band is Band I and Band II and Band IV and Band V. The CDMA/1XEV-DO band is BC1 and BC0 and BC10. The LTE frequency band is B2 and B3 and B4 and B5 and B7 and B12 and B13 and B17 and B25 and B26 and B29 and B30 and B41. But only GSM850 and GSM1900MHz and WCDMA Band II and Band IV and Band V and CDMA BC1 and BC0 and BC10 and LTE B2 and LTE B4 and LTE B5 and LTE B7 and LTE B12 and LTE B13 and LTE B17 and LTE B25 and LTE B26 and B30 and LTE B41 bands test data included in this report. The Mobile Phone implements such functions as RF signal receiving/transmitting, LTE/HSPA/UMTS and GSM/GPRS/EDGE and CDMA2000 1x and 1XEV-DO protocol processing, voice, video MMS service, GPS, AGPS NFC and WIFI etc. Externally it provides micro SD card interface (it can also used as micro SD card interface), earphone port (to provide voice service) and USIM card interface. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

3.2 EUT Identity

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

3.2.1 Board

| Board | | |
|---|------------------|--------------------|
| Description | Hardware Version | Software Version |
| Main board of Mobile Phone : HL1NINAMH | HL1NINAMH | User release M MDA |

3.2.2 Sub-Assembly

| Sub-Assembly | | | |
|-------------------|--------------|-------------------------------|--|
| Sub-Assembly Name | Model | Manufacturer | Description |
| Adapter | HW-050300U00 | Huawei Technologies Co., Ltd. | Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W |
| Adapter | HW-050300E00 | Huawei Technologies | Input Voltage: ~100-240V 50/60Hz 0.5A |



| Sub-Assembly | | | |
|-------------------|--------------|-------------------------------|---|
| Sub-Assembly Name | Model | Manufacturer | Description |
| | | Co., Ltd. | Output Voltage: 5V  3A Rated Power: 5W |
| Adapter | HW-050300B00 | Huawei Technologies Co., Ltd. | Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W |
| Adapter | HW-050300A00 | Huawei Technologies Co., Ltd. | Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W |
| Adapter | HW-050300J00 | Huawei Technologies Co., Ltd. | Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W |
| Adapter | HW-050300R00 | Huawei Technologies Co., Ltd. | Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W |
| Adapter | HW-050300I00 | Huawei Technologies Co., Ltd. | Input Voltage: ~100-240V 50/60Hz 0.5A Output Voltage: 5V  3A Rated Power: 5W |
| Battery | HB416683ECW | Huawei Technologies Co., Ltd. | Rated capacity: 3450mAh Nominal Voltage:  +3.8V Charging Voltage:  +4.35V |



3.3 Technical Specification

| Characteristics | Description | |
|-------------------------------|--|-------------------------------------|
| Radio System Type | <input checked="" type="checkbox"/> CDMA <input checked="" type="checkbox"/> GSM <input checked="" type="checkbox"/> UMTS <input checked="" type="checkbox"/> LTE | |
| Supported Frequency Range | CDMA BC0 | Transmission (TX): 824 to 849 MHz |
| | | Receiving (RX): 869 to 894 MHz |
| | CDMA BC1 | Transmission (TX): 1850 to 1910 MHz |
| | | Receiving (RX): 1930 to 1990 MHz |
| | CDMA BC10 | Transmission (TX): 816 to 824 MHz |
| | | Receiving (RX): 861 to 869 MHz |
| | GSM850/ WCDMA850 | Transmission (TX): 824 to 849 MHz |
| | | Receiving (RX): 869 to 894 MHz |
| | GSM1900/ WCDMA1900 | Transmission (TX): 1850 to 1910 MHz |
| | | Receiving (RX): 1930 to 1990 MHz |
| | WCDMA1700 | Transmission (TX): 1710 to 1755 MHz |
| | | Receiving (RX): 2110 to 2155 MHz |
| | LTE BAND2 | Transmission (TX): 1850 to 1910 MHz |
| | | Receiving (RX): 1930 to 1990 MHz |
| | LTE BAND4 | Transmission (TX): 1710 to 1755 MHz |
| | | Receiving (RX): 2110 to 2155 MHz |
| | LTE BAND5 | Transmission (TX): 824 to 849 MHz |
| | | Receiving (RX): 869 to 894 MHz |
| | LTE BAND7 | Transmission (TX): 2500 to 2570 MHz |
| | | Receiving (RX): 2620 to 2690 MHz |
| LTE BAND12 | Transmission (TX): 699 to 716 MHz | |
| | Receiving (RX): 729 to 746 MHz | |
| LTE BAND13 | Transmission (TX): 777 to 787 MHz | |
| | Receiving (RX): 746 to 756 MHz | |
| LTE BAND17 | Transmission (TX): 704 to 716 MHz | |
| | Receiving (RX): 734 to 746 MHz | |
| LTE BAND25 | Transmission (TX): 1850 to 1915MHz | |
| | Receiving (RX): 1930 to 1995 MHz | |
| LTE band26(814 to 824 MHz) | Transmission (TX): 814 to 824MHz | |
| | Receiving (RX): 859 to 869MHz | |
| LTE band26(824 to 849 MHz) | Transmission (TX): 824 to 849 MHz | |
| | Receiving (RX): 869 to 894 MHz | |
| LTE Band 30(2305 to 2315 MHz) | Transmission (TX): 2305 to 2315 MHz | |
| | Receiving (RX): 2350 to 2360 MHz | |
| LTE BAND41 | Transmission (TX): 2496 to 2690 MHz | |



| Characteristics | Description | |
|-----------------------------|--|---|
| | | Receiving (RX): 2496 to 2690 MHz |
| TX and RX Antenna Ports | TX & RX port: | 1 |
| | TX-only port: | 0 |
| | RX-only port: | 1 |
| Target TX Output Power | CDMA BC0: 24dBm CDMA BC1: 23.4dBm CDMA BC10: 24dBm GSM850: 32.5dBm GSM1900 30dBm UMTS850 23.5dBm UMTS1900: 22dBm UMTS1700: 22dBm LTE BAND2: 21.8dBm LTE BAND4: 22dBm LTE BAND5: 22.5 dBm LTE BAND7: 22.5dBm LTE BAND12: 22.5dBm LTE BAND13: 22.5dBm LTE BAND17: 22.5 dBm LTE BAND25: 21.7dBm LTE band 26(814 to 824 MHz): 22.5 dBm LTE band 26(824 to 849 MHz): 22.5 dBm LTE Band 30(2305 to 2315 MHz):21.7 dBm LTE BAND41: 21.7dBm | |
| Supported Channel Bandwidth | CDMA system: | <input checked="" type="checkbox"/> 1.25 MHz |
| | GSM system: | <input checked="" type="checkbox"/> 200 kHz |
| | UMTS system: | <input checked="" type="checkbox"/> 5 MHz |
| | LTE band 2 | <input checked="" type="checkbox"/> 1.4 MHz, <input checked="" type="checkbox"/> 3 MHz, <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz, <input checked="" type="checkbox"/> 15 MHz, <input checked="" type="checkbox"/> 20 MHz |
| | LTE band 4 | <input checked="" type="checkbox"/> 1.4 MHz, <input checked="" type="checkbox"/> 3 MHz, <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz, <input checked="" type="checkbox"/> 15 MHz, <input checked="" type="checkbox"/> 20 MHz |
| | LTE band 5 | <input checked="" type="checkbox"/> 1.4 MHz, <input checked="" type="checkbox"/> 3 MHz, <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz |
| | LTE band 7 | <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz, <input checked="" type="checkbox"/> 15 MHz, <input checked="" type="checkbox"/> 20 MHz |
| | LTE band 12 | <input checked="" type="checkbox"/> 1.4 MHz, <input checked="" type="checkbox"/> 3 MHz, <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz |
| | LTE band 13 | <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz |
| | LTE band 17 | <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz |
| | LTE band 25 | <input checked="" type="checkbox"/> 1.4 MHz, <input checked="" type="checkbox"/> 3 MHz, <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz, <input checked="" type="checkbox"/> 15 MHz, <input checked="" type="checkbox"/> 20 MHz |
| | LTE band 26(814 to 824MHz) | <input checked="" type="checkbox"/> 1.4 MHz <input checked="" type="checkbox"/> 3 MHz, <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz |
| | LTE band 26(824 to 849MHz) | <input checked="" type="checkbox"/> 1.4 MHz, <input checked="" type="checkbox"/> 3 MHz, <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz, <input checked="" type="checkbox"/> 15 MHz, |

| Characteristics | Description | |
|---|--|---|
| | LTE Band 30(2305 to 2315 MHz) | <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz |
| | LTE band 41 | <input checked="" type="checkbox"/> 5 MHz, <input checked="" type="checkbox"/> 10 MHz, <input checked="" type="checkbox"/> 15 MHz, <input checked="" type="checkbox"/> 20 MHz |
| Designation of Emissions (Note: the necessary bandwidth of which is the worst value from the measured occupied bandwidths for each type of channel bandwidth configuration.) | CDMA BC 0 | 1M30F6W |
| | CDMA BC 1 | 1M30F6W |
| | CDMA BC 10 | 1M29F6W |
| | GSM850: | 244KGXW, 247KG7W |
| | GSM1900: | 248KGXW, 245KG7W |
| | UMTS850: | 4M15F9W |
| | UMTS1900: | 4M14F9W |
| | UMTS1700: | 4M14F9W |
| | LTE BAND2: | 1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) 18M0G7D (20 MHz QPSK modulation), 18M0W7D (20 MHz 16QAM modulation) |
| | LTE BAND4: | 1M09G7D (1.4 MHz QPSK modulation), 1M09 W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) 18M0G7D (20 MHz QPSK modulation), 18M0W7D (20 MHz 16QAM modulation) |
| LTE BAND5: | 1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M701G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), | |



| Characteristics | Description |
|------------------------------|--|
| | 9M00W7D (10 MHz 16QAM modulation) |
| LTE BAND7: | 4M50G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) 18M0G7D (20 MHz QPSK modulation), 18M0W7D (20 MHz 16QAM modulation) |
| LTE BAND12: | 1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M50DW7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) |
| LTE BAND13: | 4M50G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 8M98G7D (10 MHz QPSK modulation), 8M97W7D (10 MHz 16QAM modulation) |
| LTE BAND17: | 4M50G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 8M98G7D (10 MHz QPSK modulation), 8M97W7D (10 MHz 16QAM modulation) |
| LTE BAND25 | 1M09G7D (1.4 MHz QPSK modulation), 1M10W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) 18M0G7D (20 MHz QPSK modulation), 18M0W7D (20 MHz 16QAM modulation) |
| LTE band 26(814 to 824 MHz) | 1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) |

| Characteristics | Description | |
|-----------------|-------------------------------|--|
| | | 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) |
| | LTE band 26(824 to 849 MHz) | 1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) |
| | LTE Band 30(2305 to 2315 MHz) | 4M50G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) |
| | LTE BAND41 | 4M49G7D (5 MHz QPSK modulation), 4M49W7D (5 MHz 16QAM modulation) 9M00G7D (10 MHz QPSK modulation), 9M00W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) 18M0G7D (20 MHz QPSK modulation), 18M0W7D (20 MHz 16QAM modulation) |



4 General Test Conditions / Configurations

4.1 Test Modes

NOTE: The test mode(s) are selected according to relevant radio technology specifications.

| Test Mode | Test Modes Description |
|-----------|---------------------------------------|
| CDMA/TM1 | CDMA2000 1x mode QPSK modulation |
| CDMA/TM3 | CDMA2000 1x mode HPSK modulation |
| GSM/TM1 | GSM system, GSM/GPRS, GMSK modulation |
| GSM/TM2 | GSM system, EDGE, 8PSK modulation |
| UMTS/TM1 | WCDMA system, QPSK modulation |
| UMTS/TM2 | HSDPA system, QPSK modulation |
| UMTS/TM3 | HSUPA system, QPSK modulation |
| LTE/TM1 | LTE system, QPSK modulation |
| LTE/TM2 | LTE system, 16QAM modulation |

4.2 Test Environment

| Environment Parameter | Selected Values During Tests | |
|-----------------------|------------------------------|---------|
| Relative Humidity | Ambient | |
| Temperature | TN | Ambient |
| Voltage | VL | 3.5V |
| | VN | 3.8V |
| | VH | 4.35V |

NOTE: VL= lower extreme test voltage
VN= nominal voltage
VH= upper extreme test voltage
TN= normal temperature



4.3 Test Frequency

| Test Mode | TX / RX | RF Channel | | |
|-----------|---------|--------------|-------------|--------------|
| | | Low (L) | Middle (M) | High (H) |
| CDMA BC0 | TX | Channel 1013 | Channel 384 | Channel 777 |
| | | 824.7MHz | 836.52MHz | 848.31MHz |
| | RX | Channel 1013 | Channel 384 | Channel 777 |
| | | 869.7MHz | 881.52MHz | 893.31MHz |
| CDMA BC1 | TX | Channel 25 | Channel 600 | Channel 1175 |
| | | 1851.25MHz | 1880.0MHz | 1908.75MHz |
| | RX | Channel 25 | Channel 600 | Channel 1175 |
| | | 1931.25MHz | 1960.0MHz | 1988.75MHz |
| CDMA BC10 | TX | Channel 476 | Channel 580 | Channel 684 |
| | | 817.9MHz | 820.5MHz | 823.1MHz |
| | RX | Channel 476 | Channel 580 | Channel 684 |
| | | 862.9MHz | 865.5MHz | 868.1MHz |

| Test Mode | TX / RX | RF Channel | | |
|-----------|---------|--------------|--------------|--------------|
| | | Low (L) | Middle (M) | High (H) |
| GSM850 | TX | Channel 128 | Channel 190 | Channel 251 |
| | | 824.2MHz | 836.6MHz | 848.8MHz |
| | RX | Channel 128 | Channel 190 | Channel 251 |
| | | 869.2MHz | 881.6MHz | 893.8MHz |
| WCDMA850 | TX | Channel 4132 | Channel 4182 | Channel 4233 |
| | | 826.4MHz | 836.4MHz | 846.6MHz |
| | RX | Channel 4357 | Channel 4407 | Channel 4458 |



| Test Mode | TX / RX | RF Channel | | |
|-----------|---------|--------------|--------------|--------------|
| | | Low (L) | Middle (M) | High (H) |
| | | 871.4MHz | 881.4MHz | 891.6MHz |
| Test Mode | TX / RX | RF Channel | | |
| | | Low (L) | Middle (M) | High (H) |
| GSM1900 | TX | Channel 512 | Channel 661 | Channel 810 |
| | | 1850.2MHz | 1880.0MHz | 1909.8MHz |
| | RX | Channel 512 | Channel 661 | Channel 810 |
| | | 1930.2 MHz | 1960.0 MHz | 1989.8 MHz |
| WCDMA1900 | TX | Channel 9262 | Channel9400 | Channel9538 |
| | | 1852.4MHz | 1880.0MHz | 1907.6MHz |
| | RX | Channel 9662 | Channel 9800 | Channel 9938 |
| | | 1932.4 MHz | 1960.0 MHz | 1987.6 MHz |

| Test Mode | TX / RX | RF Channel | | |
|-----------|---------|--------------|--------------|--------------|
| | | Low (L) | Middle (M) | High (H) |
| WCDMA1700 | TX | Channel1312 | Channel1413 | Channel1513 |
| | | 1712.4MHz | 1732.6MHz | 1752.6MHz |
| | RX | Channel 1537 | Channel 1638 | Channel 1738 |
| | | 2112.4 MHz | 2132.6 MHz | 2152.6 MHz |

| Test Mode | TX / RX | RF Channel | | |
|------------|----------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| LTE Band 2 | TX(1.4M) | Channel 18607 | Channel 18900 | Channel 19193 |
| | | 1850.7 MHz | 1880 MHz | 1909.3 MHz |
| | TX(3M) | Channel 18615 | Channel 18900 | Channel 19185 |



| Test Mode | TX / RX | RF Channel | | |
|-----------|----------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| | | 1851.5 MHz | 1880 MHz | 1908.5 MHz |
| | TX(5M) | Channel 18625 | Channel 18900 | Channel 19175 |
| | | 1852.5 MHz | 1880 MHz | 1907.5 MHz |
| | TX(10M) | Channel 18650 | Channel 18900 | Channel 19150 |
| | | 1855 MHz | 1880 MHz | 1905 MHz |
| | TX(15M) | Channel 18675 | Channel 18900 | Channel 19125 |
| | | 1857.5 MHz | 1880 MHz | 1902.5 MHz |
| | TX(20M) | Channel 18700 | Channel 18900 | Channel 19100 |
| | | 1860 MHz | 1880 MHz | 1900 MHz |
| | RX(1.4M) | Channel 607 | Channel 900 | Channel 1193 |
| | | 1930.7 MHz | 1960 MHz | 1989.3 MHz |
| | RX(3M) | Channel 615 | Channel 900 | Channel 1185 |
| | | 1931.5 MHz | 1960 MHz | 1988.5 MHz |
| | RX(5M) | Channel 625 | Channel 900 | Channel 1175 |
| | | 1932.5 MHz | 1960 MHz | 1987.5 MHz |
| | RX(10M) | Channel 650 | Channel 900 | Channel 1150 |
| | | 1935 MHz | 1960 MHz | 1985 MHz |
| | RX(15M) | Channel 675 | Channel 900 | Channel 1125 |
| | | 1937.5 MHz | 1960 MHz | 1982.5 MHz |
| | RX(20M) | Channel 700 | Channel 900 | Channel 1100 |
| | | 1940 MHz | 1960 MHz | 1980 MHz |

| Test Mode | TX / RX | RF Channel | | |
|-----------|---------|------------|------------|----------|
| | | Low (B) | Middle (M) | High (T) |



| Test Mode | TX / RX | RF Channel | | |
|------------|----------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| LTE Band 4 | TX(1.4M) | Channel 19957 | Channel 20175 | Channel 20393 |
| | | 1710.7 MHz | 1732.5 MHz | 1754.3 MHz |
| | TX(3M) | Channel 19965 | Channel 20175 | Channel 20385 |
| | | 1711.5 MHz | 1732.5 MHz | 1753.5 MHz |
| | TX(5M) | Channel 19975 | Channel 20175 | Channel 20375 |
| | | 1712.5 MHz | 1732.5 MHz | 1752.5 MHz |
| | TX(10M) | Channel 20000 | Channel 20175 | Channel 20350 |
| | | 1715 MHz | 1732.5 MHz | 1750 MHz |
| | TX(15M) | Channel 20025 | Channel 20175 | Channel 20325 |
| | | 1717.5 MHz | 1732.5 MHz | 1747.5 MHz |
| | TX(20M) | Channel 20050 | Channel 20175 | Channel 20300 |
| | | 1720 MHz | 1732.5 MHz | 1745 MHz |
| | RX(1.4M) | Channel 1975 | Channel 2175 | Channel 2375 |
| | | 2112.5 MHz | 2132.5MHz | 2152.5 MHz |
| | RX(3M) | Channel 2000 | Channel 2175 | Channel 2350 |
| | | 2115 MHz | 2132.5MHz | 2150 MHz |
| | RX(5M) | Channel 1975 | Channel 2175 | Channel 2375 |
| | | 2112.5 MHz | 2132.5MHz | 2152.5 MHz |
| | RX(10M) | Channel 2000 | Channel 2175 | Channel 2350 |
| | | 2115 MHz | 2132.5MHz | 2150 MHz |
| | RX(15M) | Channel 2025 | Channel 2175 | Channel 2325 |
| | | 2117.5 MHz | 2132.5MHz | 2147.5 MHz |
| | RX(20M) | Channel 2050 | Channel 2175 | Channel 2300 |
| | | 2120 MHz | 2132.5MHz | 2145 MHz |



| Test Mode | TX / RX | RF Channel | | |
|------------|----------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| LTE Band 5 | TX(1.4M) | Channel 20407 | Channel 20525 | Channel 20643 |
| | | 824.7 MHz | 836.5 MHz | 848.3 MHz |
| | TX(3M) | Channel 20415 | Channel 20525 | Channel 20635 |
| | | 825.5 MHz | 836.5 MHz | 847.5 MHz |
| | TX(5M) | Channel 20425 | Channel 20525 | Channel 20625 |
| | | 826.5 MHz | 836.5 MHz | 846.5 MHz |
| | TX(10M) | Channel 20450 | Channel 20525 | Channel 20600 |
| | | 829 MHz | 836.5 MHz | 844 MHz |
| | RX(1.4M) | Channel 2407 | Channel 2525 | Channel 2643 |
| | | 869.7 MHz | 881.5 MHz | 893.3 MHz |
| | RX (3M) | Channel 2415 | Channel 2525 | Channel 2635 |
| | | 870.5 MHz | 881.5 MHz | 892.5 MHz |
| | RX(5M) | Channel 2425 | Channel 2525 | Channel 2625 |
| | | 871.5 MHz | 881.5 MHz | 891.5 MHz |
| | RX (10M) | Channel 2450 | Channel 2525 | Channel 2600 |
| | | 874 MHz | 881.5 MHz | 889 MHz |

| Test Mode | TX / RX | RF Channel | | |
|------------|----------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| LTE Band 7 | TX (5M) | Channel 20775 | Channel 21100 | Channel 21425 |
| | | 2502.5 MHz | 2535 MHz | 2567.5 MHz |
| | TX (10M) | Channel 20800 | Channel 21100 | Channel 21400 |
| | | 2505 MHz | 2535 MHz | 2565 MHz |



| Test Mode | TX / RX | RF Channel | | |
|-----------|----------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| | TX (15M) | Channel 20825 | Channel 21100 | Channel 21375 |
| | | 2507.5 MHz | 2535 MHz | 2562.5 MHz |
| | TX (20M) | Channel 20850 | Channel 21100 | Channel 21350 |
| | | 2510 MHz | 2535 MHz | 2560 MHz |
| | RX (5M) | Channel 2775 | Channel 3100 | Channel 3425 |
| | | 2622.5 MHz | 2655 MHz | 2687.5 MHz |
| | RX (10M) | Channel 2800 | Channel 3100 | Channel 3400 |
| | | 2625 MHz | 2655 MHz | 2685 MHz |
| | RX (15M) | Channel 2825 | Channel 3100 | Channel 3375 |
| | | 2627.5 MHz | 2655 MHz | 2682.5 MHz |
| | RX (20M) | Channel 2850 | Channel 3100 | Channel 3350 |
| | | 2630 MHz | 2655 MHz | 2680 MHz |

| Test Mode | TX / RX | RF Channel | | |
|-------------|----------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| LTE Band 12 | TX(1.4M) | Channel 23017 | Channel 23095 | Channel 23173 |
| | | 699.7 MHz | 707.5 MHz | 715.3 MHz |
| | TX(3M) | Channel 23025 | Channel 23095 | Channel 23165 |
| | | 700.5 MHz | 707.5 MHz | 714.5 MHz |
| | TX(5M) | Channel 23035 | Channel 23095 | Channel 23155 |
| | | 701.5 MHz | 707.5 MHz | 713.5 MHz |
| | TX(10M) | Channel 23060 | Channel 23095 | Channel 23130 |
| | | 704 MHz | 707.5 MHz | 711 MHz |



| Test Mode | TX / RX | RF Channel | | |
|-----------|----------|--------------|--------------|--------------|
| | | Low (B) | Middle (M) | High (T) |
| | RX(1.4M) | Channel 5017 | Channel 5095 | Channel 5173 |
| | | 729.7 MHz | 737.5 MHz | 745.3 MHz |
| | RX (3M) | Channel 5025 | Channel 5095 | Channel 5165 |
| | | 730.5 MHz | 737.5 MHz | 744.5 MHz |
| | RX(5M) | Channel 5035 | Channel 5095 | Channel 5155 |
| | | 731.5 MHz | 737.5 MHz | 743.5 MHz |
| | RX (10M) | Channel 5060 | Channel 5095 | Channel 5130 |
| | | 734 MHz | 737.5 MHz | 741 MHz |

| Test Mode | TX / RX | RF Channel | | |
|-------------|----------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| LTE Band 13 | TX(5M) | Channel 23205 | Channel 23230 | Channel 23255 |
| | | 779.5 MHz | 782 MHz | 784.5 MHz |
| | TX(10M) | Channel 23230 | Channel 23230 | Channel 23230 |
| | | 782 MHz | 782 MHz | 782 MHz |
| | RX(5M) | Channel 5205 | Channel 5230 | Channel 5255 |
| | | 748.35 MHz | 751 MHz | 753.5 MHz |
| | RX (10M) | Channel 5230 | Channel 5230 | Channel 5230 |
| | | 751 MHz | 751 MHz | 751 MHz |

| Test Mode | TX / RX | RF Channel | | |
|-------------|---------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| LTE Band 17 | TX (5M) | Channel 23755 | Channel 23790 | Channel 23825 |
| | | 706.5 MHz | 710 MHz | 713.5 MHz |



| Test Mode | TX / RX | RF Channel | | |
|-----------|----------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| | TX (10M) | Channel 23780 | Channel 23790 | Channel 23800 |
| | | 709 MHz | 710 MHz | 711 MHz |
| | RX (5M) | Channel 5755 | Channel 5790 | Channel 5825 |
| | | 736.5 MHz | 740 MHz | 743.5 MHz |
| | RX (10M) | Channel 5780 | Channel 5790 | Channel 5800 |
| | | | | |

| Test Mode | TX / RX | RF Channel | | |
|-------------|-----------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| LTE Band 25 | TX (1.4M) | Channel 26047 | Channel 26365 | Channel 26683 |
| | | 1850.7 | 1882.5 | 1914.3 |
| | TX (3M) | Channel 26055 | Channel 26365 | Channel 26675 |
| | | 1851.5 | 1882.5 | 1913.5 |
| | TX (5M) | Channel 26065 | Channel 26365 | Channel 26665 |
| | | 1852.5 | 1882.5 | 1912.5 |
| | TX (10M) | Channel 26090 | Channel 26365 | Channel 26640 |
| | | 1855 | 1882.5 | 1910 |
| | TX (15M) | Channel 26115 | Channel 26365 | Channel 26615 |
| | | 1857.5 | 1882.5 | 1907.5 |
| | TX (20M) | Channel 26140 | Channel 26365 | Channel 26590 |
| | | 1860 | 1882.5 | 1905 |
| | RX (1.4M) | Channel 8047 | Channel 8365 | Channel 8683 |
| | | 1930.7 | 1962.5 | 1994.3 |
| | RX (3M) | Channel 8055 | Channel 8365 | Channel 8675 |
| | | 1931.5 | 1962.5 | 1993.5 |



| Test Mode | TX / RX | RF Channel | | |
|-----------|----------|--------------|--------------|--------------|
| | | Low (B) | Middle (M) | High (T) |
| | RX (5M) | Channel 8065 | Channel 8365 | Channel 8665 |
| | | 1932.5 | 1962.5 | 1992.5 |
| | RX (10M) | Channel 8090 | Channel 8365 | Channel 8640 |
| | | 1935 | 1962.5 | 1990 |
| | RX (15M) | Channel 8115 | Channel 8365 | Channel 8615 |
| | | 1937.5 | 1962.5 | 1987.5 |
| | RX (20M) | Channel 8140 | Channel 8365 | Channel 8590 |
| | | 1940 | 1962.5 | 1985 |

| Test Mode | TX / RX | RF Channel | | |
|-------------------------------------|-----------|---------------|---------------|---------------|
| | | Low (L) | Middle (M) | High (H) |
| LTE Band 26 (814 to 824 MHz) | TX (1.4M) | Channel 26697 | Channel 26740 | Channel 26783 |
| | | 814.7 MHz | 819 MHz | 823.3 MHz |
| | TX (3M) | Channel 26705 | Channel 26740 | Channel 26775 |
| | | 815.5 MHz | 819 MHz | 822.5 MHz |
| | TX (5M) | Channel 26715 | Channel 26740 | Channel 26765 |
| | | 816.5 MHz | 819 MHz | 821.5 MHz |
| | TX (10M) | Channel 26740 | Channel 26740 | Channel 26740 |
| | | 819 MHz | 819 MHz | 819 MHz |
| | RX (1.4M) | Channel 8697 | Channel 8740 | Channel 8783 |
| | | 859.7 MHz | 864 MHz | 868.3 MHz |
| | RX (3M) | Channel 8705 | Channel 8740 | Channel 8765 |
| | | 860.5 MHz | 864 MHz | 867.5 MHz |
| | RX (5M) | Channel 8715 | Channel 8740 | Channel 8765 |



| Test Mode | TX / RX | RF Channel | | |
|-----------|----------|--------------|--------------|--------------|
| | | Low (L) | Middle (M) | High (H) |
| | | 861.5 MHz | 864 MHz | 866.5 MHz |
| | RX (10M) | Channel 8740 | Channel 8740 | Channel 8740 |
| | | 864 MHz | 864 MHz | 864 MHz |

| Test Mode | TX / RX | RF Channel | | |
|---------------------------------|-----------|---------------|---------------|---------------|
| | | Low (L) | Middle (M) | High (H) |
| LTE Band 26 (824 to 849 MHz) | TX (1.4M) | Channel 26797 | Channel 26915 | Channel 27033 |
| | | 824.7 MHz | 836.5 MHz | 848.3 MHz |
| | TX (3M) | Channel 26805 | Channel 26915 | Channel 27025 |
| | | 825.5 MHz | 836.5 MHz | 847.5 MHz |
| | TX (5M) | Channel 26815 | Channel 26915 | Channel 27015 |
| | | 826.5 MHz | 836.5 MHz | 846.5 MHz |
| | TX (10M) | Channel 26840 | Channel 26915 | Channel 26990 |
| | | 829 MHz | 836.5 MHz | 844 MHz |
| | TX (15M) | Channel 26865 | Channel 26915 | Channel 26965 |
| | | 831.5 MHz | 836.5 MHz | 841.5 MHz |
| | RX (1.4M) | Channel 8697 | Channel 8915 | Channel 9033 |
| | | 859.7 MHz | 881.5 MHz | 893.3 MHz |
| | RX (3M) | Channel 8805 | Channel 8915 | Channel 9025 |
| | | 860.5 MHz | 881.5 MHz | 892.5 MHz |
| | RX (5M) | Channel 8815 | Channel 8915 | Channel 9015 |
| | | 871.5 MHz | 881.5 MHz | 891.5 MHz |
| | RX (10M) | Channel 8840 | Channel 8915 | Channel 8990 |
| | | 874 MHz | 881.5 MHz | 889 MHz |



| Test Mode | TX / RX | RF Channel | | |
|-----------|----------|--------------|--------------|--------------|
| | | Low (L) | Middle (M) | High (H) |
| | RX (15M) | Channel 8865 | Channel 8915 | Channel 8965 |
| | | 876.5 MHz | 881.5 MHz | 886.5 MHz |

| Test Mode | TX / RX | RF Channel | | |
|---------------------------|----------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| LTE Band 30(2305-2315MHz) | TX (5M) | Channel 27685 | Channel 27710 | Channel 27735 |
| | | 2307.5 MHz | 2310 MHz | 2312.5 MHz |
| | TX (10M) | Channel 27710 | Channel 27710 | Channel 27710 |
| | | 2310 MHz | 2310 MHz | 2310MHz |
| | RX (5M) | Channel 9795 | Channel 9820 | Channel 9845 |
| | | 2352.5 MHz | 2355 MHz | 2357.5 MHz |
| | RX (10M) | Channel 9820 | Channel 9820 | Channel 9820 |
| | | 2355 MHz | 2355 MHz | 2355 MHz |

| Test Mode | TX / RX | RF Channel | | |
|-------------|---------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| LTE Band 41 | TX(5M) | Channel 39675 | Channel 40620 | Channel 41565 |
| | | 2498.5 MHz | 2593 MHz | 2687.5 MHz |
| | TX(10M) | Channel 39700 | Channel 40620 | Channel 41540 |
| | | 2504 MHz | 2593 MHz | 2685 MHz |
| | TX(15M) | Channel 39725 | Channel 40620 | Channel 41515 |
| | | 2503.5 MHz | 2593 MHz | 2682.5 MHz |
| | TX(20M) | Channel 39750 | Channel 40620 | Channel 41490 |
| | | 2506 MHz | 2593 MHz | 2680 MHz |



| Test Mode | TX / RX | RF Channel | | |
|-----------|---------|---------------|---------------|---------------|
| | | Low (B) | Middle (M) | High (T) |
| | RX(5M) | Channel 39675 | Channel 40620 | Channel 41565 |
| | | 2498.5 MHz | 2593 MHz | 2687.5 MHz |
| | RX(10M) | Channel 39700 | Channel 40620 | Channel 41540 |
| | | 2504 MHz | 2593 MHz | 2685 MHz |
| | RX(15M) | Channel 39725 | Channel 40620 | Channel 41515 |
| | | 2503.5 MHz | 2593 MHz | 2682.5 MHz |
| | RX(20M) | Channel 39750 | Channel 40620 | Channel 41490 |
| | | 2506 MHz | 2593 MHz | 2680 MHz |

4.4 Description of tests

4.4.1 Radiated Power and Radiated Spurious Emissions

Radiated spurious emissions are investigated indoors in a semi-anechoic chamber to determine the frequencies producing the worst case emissions. Final measurements for radiated power and radiated spurious emissions are performed on the 3 meter OATS per the guidelines of ANSI/TIA-603-C-2004. The equipment under test was transmitting while connected to its integral antenna and is placed on a wooden turntable 80cm above the ground plane and 3 meters from the receive antenna. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Emissions are also investigated with the receive antenna horizontally and vertically polarized.

A portable or small unlicensed wireless device shall be placed on a non-metallic test fixture or other non-metallic support during testing. The supporting fixture shall permit orientation of the EUT in each of three orthogonal (x, y, z) axis positions such that emissions from the EUT are maximized. Measure the EUT maximum RF power and record the result.

A half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_d \text{ [dBm]} = P_g \text{ [dBm]} - \text{cable loss [dB]} + \text{antenna gain [dBd/dBi]}$$

Where, P_d is the dipole equivalent power, P_g is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to $P_g \text{ [dBm]} - \text{cable loss [dB]}$.

The calculated P_d levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of $43 + 10\log_{10}(\text{Power}_{\text{[Watts]}})$.

Note: Reference test setup 3



4.4.2 Occupied Bandwidth

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

Note: Reference test setup 1.

4.4.3 Spurious and Harmonic Emissions at Antenna Terminal

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

Note: Reference test setup 1.

4.4.4 Peak-Average Ratio

A peak to average ratio measurement is performed at the conducted port of the EUT. For WCDMA signals, the spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. For GSM signals, an average and a peak trace are used on a spectrum analyzer to determine the largest deviation between the average and the peak power of the EUT in a bandwidth greater than the emission bandwidth. The traces are generated with the spectrum analyzer set to zero span mode.

Note: Reference test setup 1.



4.4.5 Frequency Stability / Temperature Variation

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-C-2004. The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Specification – The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency.

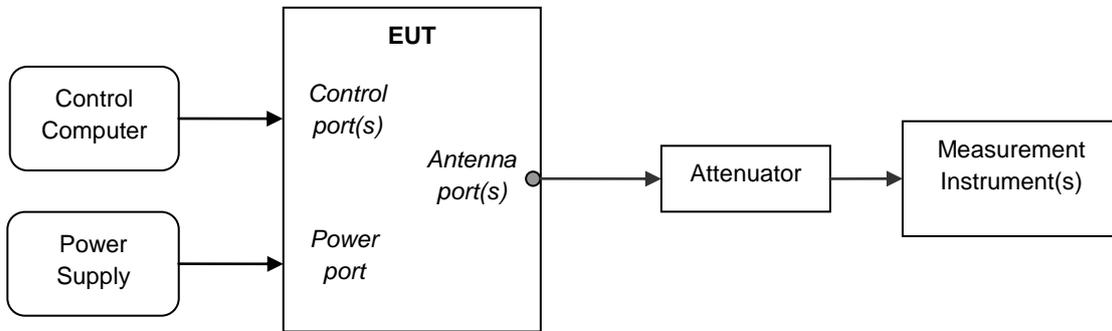
Time Period and Procedure:

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

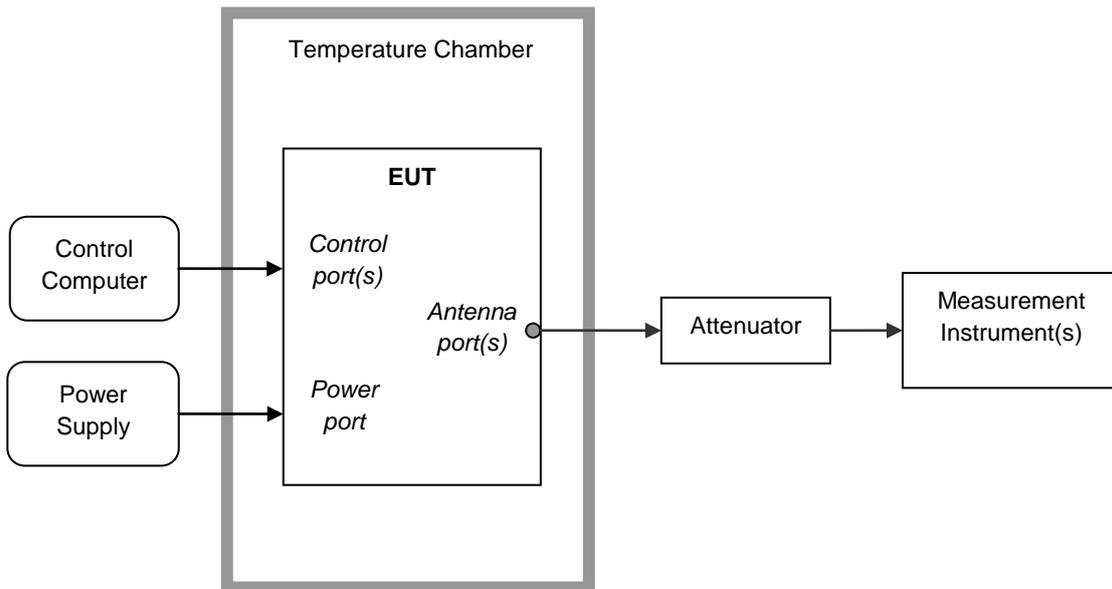
Note: Reference test setup 2.

4.5 Test Setups

4.5.1 Test Setup 1



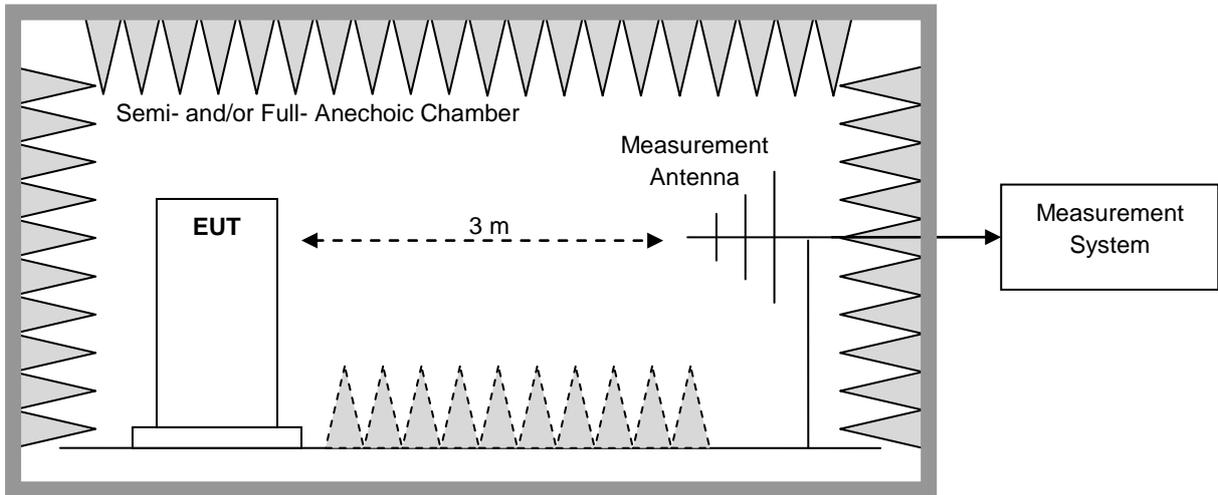
4.5.2 Test Setup 2



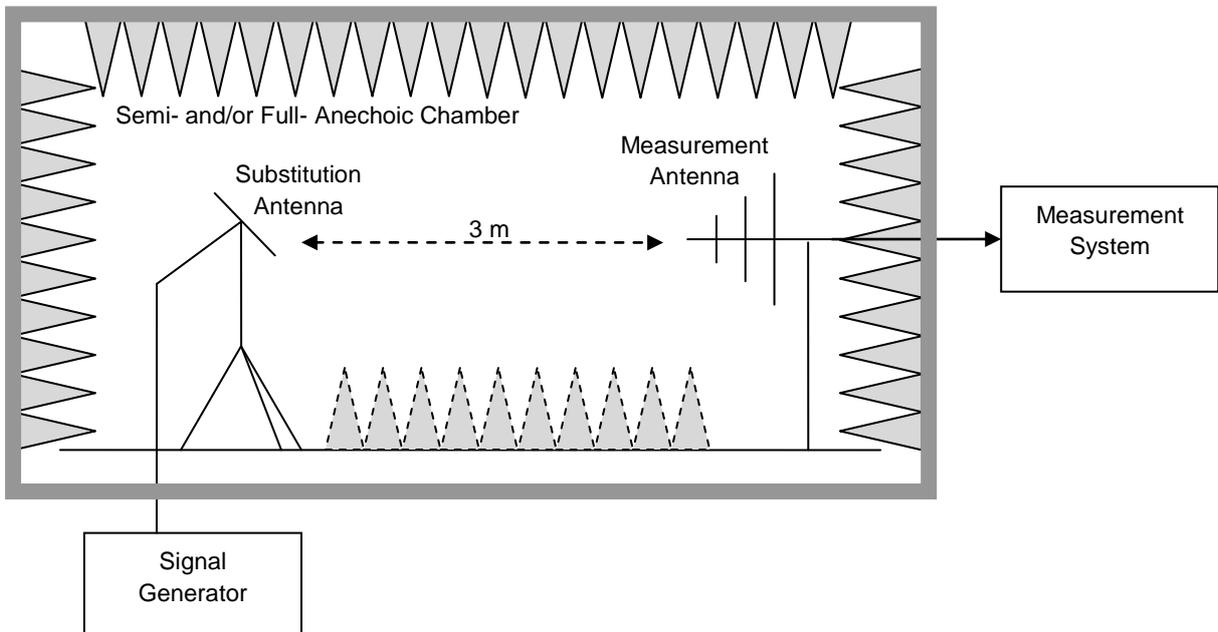
4.5.3 Test Setup 3

NOTE: Effective radiated power (ERP) refers to the radiation power output of the EUT, assuming all emissions are radiated from half-wave dipole antennas.

4.5.3.1 Step 1: Pre-test



4.5.3.2 Step 2: Substitution method to verify the maximum ERP



4.6 Test Conditions

| Test Case | | Test Conditions | |
|-------------------------------------|---|------------------|--|
| Transmit Output Power Data | Average Power, Total | Test Env. | Ambient Climate & Rated Voltage |
| | | Test Setup | Test Seup 1 |
| | | RF Channels (TX) | L, M, H (L= low channel, M= middle channel, H= high channel) |
| | | Test Mode | CDMA/TM1,CDMA/TM3,CDMA/TM1,CDMA/TM3,GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2 |
| | Average Power, Spectral Density (if required) | Test Env. | Ambient Climate & Rated Voltage |
| | | Test Setup | Test Seup 1 |
| | | RF Channels (TX) | L, M, H (L= low channel, M= middle channel, H= high channel) |
| | | Test Mode | CDMA/TM1,CDMA/TM3,GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2 |
| Peak-to-Average Ratio (if required) | | Test Env. | Ambient Climate & Rated Voltage |
| | | Test Setup | Test Seup 1 |
| | | RF Channels (TX) | L, M, H (L= low channel, M= middle channel, H= high channel) |
| | | Test Mode | CDMA/TM1,CDMA/TM3,GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2 |
| Modulation Characteristics | | Test Env. | Ambient Climate & Rated Voltage |
| | | Test Setup | Test Seup 1 |
| | | RF Channels (TX) | M (L= low channel, M= middle channel, H= high channel) |
| | | Test Mode | CDMA/TM1,CDMA/TM3,GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2 |
| Bandwidth | Occupied Bandwidth | Test Env. | Ambient Climate & Rated Voltage |
| | | Test Setup | Test Seup 1 |
| | | RF Channels (TX) | L, M, H (L= low channel, M= middle channel, H= high channel) |
| | | Test Mode | CDMA/TM1,CDMA/TM3,GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2 |
| | Emission Bandwidth (if required) | Test Env. | Ambient Climate & Rated Voltage |
| | | Test Setup | Test Seup 1 |
| | | RF Channels (TX) | L, M, H (L= low channel, M= middle channel, H= high channel) |
| | | Test Mode | CDMA/TM1,CDMA/TM3,GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2 |
| Band Edges Compliance | | Test Env. | Ambient Climate & Rated Voltage |
| | | Test Setup | Test Seup 1 |
| | | RF Channels | L, H |



| Test Case | Test Conditions | |
|--|------------------|--|
| | (TX) | (L= low channel, M= middle channel, H= high channel) |
| | Test Mode | CDMA/TM1,CDMA/TM3,GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2 |
| Spurious Emission at Antenna Terminals | Test Env. | Ambient Climate & Rated Voltage |
| | Test Setup | Test Seup 1 |
| | RF Channels (TX) | L, M, H (L= low channel, M= middle channel, H= high channel) |
| | Test Mode | CDMA/TM1,CDMA/TM3,GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2 |
| Field Strength of Spurious Radiation | Test Env. | Ambient Climate & Rated Voltage |
| | Test Setup | Test Seup 3 |
| | Test Mode | GSM/TM1,GSM/TM2,UMTS/TM1/TM2/TM3,LTE/TM1,LTE/TM2 NOTE: If applicable, the EUT conf. that has maximum power density (based on the equivalent power level) is selected. |
| | RF Channels (TX) | L, M, H (L= low channel, M= middle channel, H= high channel) |
| Frequency Stability | Test Env. | (1) -30 °C to +50 °C with step 10 °C at Rated Voltage; (2) VL, VN and VH of Rated Voltage at Ambient Climate. |
| | Test Setup | Test Seup 2 |
| | RF Channels (TX) | L, M, H (L= low channel, M= middle channel, H= high channel) |
| | Test Mode | CDMA/TM1,CDMA/TM3,GSM/TM1,GSM/TM2,UMTS/TM1,LTE/TM1,LTE/TM2 |

**5 Main Test Instruments**

| Equipment Name | Manufacturer | Model | Serial Number | Cal Date | Cal- Due |
|---|---------------|-----------|----------------|------------|------------|
| Power supply | KEITHLEY | 2303 | A120714713 | 2014-08-07 | 2016-08-06 |
| Wireless Communication Test set | Agilent | N4010A | MY49081592 | 2014-11-04 | 2015-11-03 |
| Universal Radio Communication Tester | R&S | CMU200 | 123299 | 2014-11-04 | 2015-11-03 |
| Spectrum Analyzer | Agilent | N9020A | MY52090652 | 2015-07-08 | 2016-07-07 |
| Universal Radio Communication Tester | R & S | CMW500 | 126854 | 2015-02-13 | 2016-02-12 |
| Spectrum Analyzer | Agilent | E4440A | MY48250119 | 2015-07-08 | 2016-07-07 |
| Signal Analyzer | R&S | FSQ31 | 200021 | 2014-11-04 | 2015-11-03 |
| Spectrum Analyzer | Agilent | N9030A | MY49431698 | 2014-11-04 | 2015-11-03 |
| Temperature Chamber | WEISS | WKL64 | 56246002940010 | 2015-02-13 | 2016-02-12 |
| Signal generator | Agilent | E8257D | MY49281095 | 2014-11-04 | 2015-11-03 |
| Vector Signal Generator | R&S | SMU200A | 104162 | 2014-11-04 | 2015-11-03 |
| Power Detecting & Sampling Unit | R&S | OSP-B157 | 100881 | 2014-09-08 | 2015-10-07 |
| Signal Generator | Agilent | E4438C | MY47271904 | 2014-10-28 | 2015-10-27 |
| Test receiver | R&S | ESU26 | 100387 | 2015-6-24 | 2016-06-23 |
| Test receiver | R&S | ESCI | 101163 | 2015-6-24 | 2016-06-23 |
| Spectrum analyzer | R&S | FSU3 | 200474 | 2015-06-15 | 2016-06-14 |
| Spectrum analyzer | R&S | FSU43 | 100144 | 2015-06-15 | 2016-06-14 |
| LOOP Antennas(9kHz-30MHz) | R&S | HFH2-Z2 | 100262 | 2015-4-30 | 2017-4-29 |
| LOOP Antennas(9kHz-30MHz) | R&S | HFH2-Z2 | 100263 | 2015-4-30 | 2017-4-29 |
| Trilog Broadband Antenna (30M~3GHz) | SCHWARZ BECK | VULB 9163 | 9163-490 | 2015-4-30 | 2017-4-29 |
| Trilog Broadband Antenna (30M~3GHz) | SCHWARZ BECK | VULB 9163 | 9163-520 | 2015-4-30 | 2017-4-29 |
| Double-Ridged Waveguide Horn Antenna (1G~18GHz) | R&S | HF907 | 100304 | 2015-4-30 | 2017-4-29 |
| double ridged horn antenna (0.8G-18GHz) | R&S | HF907 | 100305 | 2015-4-30 | 2017-4-29 |
| Pyramidal Horn Antenna(18GHz-26.5GHz) | ETS-Lindgr en | 3160-09 | 5140299 | 2015-7-15 | 2017-7-14 |
| Artificial Main Network | R&S | ENV4200 | 100134 | 2015-6-24 | 2016-6-23 |
| Line Impedance Stabilization Network | R&S | ENV216 | 100382 | 2015-6-24 | 2016-6-23 |



6 Measurement Uncertainty

For a 95% confidence level ($k = 2$), the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 as following:

| Test Item | | Extended Uncertainty |
|--------------------------------------|--------------------------|---|
| Transmit Output Power Data | Power [dBm] | U = 0.39 dB |
| Bandwidth | Magnitude [%] | U = 0.2% |
| Band Edge Compliance | Disturbance Power [dBm] | U = 2.0 dB |
| Spurious Emissions, Conducted | Disturbance Power [dBm] | U = 2.0 dB |
| Field Strength of Spurious Radiation | ERP [dBm] | For 3 m Chamber: U = 4.6 dB (30 MHz to 1GHz) U = 3.0 dB (above 1 GHz) For 10 m Chamber: U = 4.6 dB (30 MHz to 1GHz) U = 3.0 dB (above 1 GHz) |
| Frequency Stability | Frequency Accuracy [ppm] | U = 0.21 ppm |

END