# FCC Test Report

Report No.:AGC01684191204FE02

| | | |
|---|---|---|
| **FCC ID** | : | 2AVZYX1 |
| **APPLICATION PURPOSE** | : | Original Equipment |
| **PRODUCT DESIGNATION** | : | ALARM SYSTEM |
| **BRAND NAME** | : | MAXKIN |
| **MODEL NAME** | : | X1, MK-X1, X1 Wi-Fi 2G PLUS, X1 Wi-Fi 3G PLUS, X1 2G PLUS, X1 3G PLUS |
| **APPLICANT** | : | Maxkin Mobile Technology Co., Ltd |
| **DATE OF ISSUE** | : | Apr. 11, 2020 |
| **STANDARD(S)** | : | FCC Part 22H & 24E Rules |
| **REPORT VERSION** | : | V1.0 |

Attestation of Global Compliance (Shenzhen) Co., Ltd.

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# REPORT REVISE RECORD

| Report Version | Revise Time | Issued Date | Valid Version | Notes |
|---|---|---|---|---|
| V1.0 | / | Apr. 11, 2020 | Valid | Initial Release |

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## 1. VERIFICATION OF COMPLIANCE

| | |
|---|---|
| **Applicant** | Maxkin Mobile Technology Co., Ltd |
| **Address** | Room 301, 3rd floor,NO.26 Laowei 1st Zone, Shuidoulaowei, Yousong Community, Longhua District, Shenzhen, China |
| **Manufacturer** | Maxkin Mobile Technology Co., Ltd |
| **Address** | Room 301, 3rd floor,NO.26 Laowei 1st Zone, Shuidoulaowei, Yousong Community, Longhua District, Shenzhen, China |
| **Factory** | Maxkin Mobile Technology Co., Ltd |
| **Address** | Room 301, 3rd floor,NO.26 Laowei 1st Zone, Shuidoulaowei, Yousong Community, Longhua District, Shenzhen, China |
| **Product Designation** | ALARM SYSTEM |
| **Brand Name** | MAXKIN |
| **Test Model** | X1 |
| **Series Model** | MK-X1, X1 Wi-Fi 2G PLUS, X1 Wi-Fi 3G PLUS, X1 2G PLUS, X1 3G PLUS |
| **Difference description** | All the same except for the model name. |
| **Date of test** | Dec. 27, 2019 to Mar. 30, 2020 |
| **Deviation** | No any deviation from the test method. |
| **Condition of Test Sample** | Normal |

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance(Shenzhen) Co., Ltd. The data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI/TIA-603-E-2016. The sample tested as described in this report is in compliance with the FCC Rules Part 22H and 24E.The test results of this report relate only to the tested sample identified in this report.

| | | |
|---|---|---|
| Prepared By | Sky Dong<br>(Project Engineer) | Apr. 11, 2020 |
| Reviewed By | MaxZhang<br>(Reviewer) | Apr. 11, 2020 |
| Approved By | Forrest Lei<br>( Authorized Officer ) | Apr. 11, 2020 |

# 2. GENERAL INFORMATION

## 2.1 PRODUCT DESCRIPTION

A major technical description of EUT is described as following:

| | |
|---|---|
| Product Designation: | ALARM SYSTEM |
| Frequency Bands: | ☒GPRS 850 ☒PCS1900 (U.S. Bands)<br>☒DCS 1800 (Non-U.S. Bands)<br>☒UMTS FDD Band II ☒UMTS FDD Band V (U.S. Bands) |
| Hardware Version | x1_tuya v1.1 |
| Software Version | V1.0.1 |
| Antenna Type | Integral antenna |
| Antenna gain | GSM850:1.52dBi; PCS1900: 2.20dBi<br>WCDMA850: 1.90dBi; WCDMA1900:2.30dBi; |
| Power Supply: | DC 3.7V by Built-in Li-ion Battery |
| Battery parameter: | DC 3.7V1000mAh |
| Single Card: | GSM /WCDMA Card Slot |
| GPRS Class | 12 |
| Extreme Vol. Limits: | DC3.15V to 4.2V (Normal: DC 3.7V) |
| Extreme Temp. Tolerance | -10℃ to +40℃ |
| *** Note: 1. The High Voltage DC4.2V and Low Voltage DC3.15V were declared by manufacturer<br>2. The EUT couldn't be operating normally with higher or lower voltage. | |

***** Note:**1.The maximum power levels are GSM for MCS-4: GMSK link, and RMC 12.2kbps mode for WCDMA band II, WCDMA band Vonly these modes were used for all tests.

2. We found out the test mode with the highest power level after we analyze all the data rates. So we chose worst caseas a representative.

**GSM/WCDMA Slot 1:**

| | Maximum ERP/EIRP (dBm) | Max. Average Burst Power (dBm) |
|---|---|---|
| GSM 850 | 30.22 | 33.75 |
| PCS 1900 | 27.63 | 28.75 |
| UMTS BAND V | 23.82 | 24.61 |
| UMTS BAND II | 21.52 | 22.58 |

## 2.2RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID:2AVZYX1**, filing to comply with the FCC Part 22H&24E requirements.

## 2.3 TEST METHODOLOGY

The radiated emission testing was performed according to the procedures of ANSI/TIA-603-E-2016, and KDB 971168 D01 Power Means License Digital Systems V03R01.

## 2.4 TEST FACILITY

| | |
|---|---|
| **TestSite** | Attestation of Global Compliance(Shenzhen) Co., Ltd |
| **Location** | 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong,China |
| **Designation Number** | CN1259 |
| **FCC Test Firm Registration Number** | 975832 |
| **A2LA Cert. No.** | 5054.02 |
| **Description** | Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA |

## ALL TEST EQUIPMENT LIST

| Equipment | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| TEST RECEIVER | R&S | ESPI | 101206 | Jun.12, 2019 | Jun.11, 2020 |
| LISN | R&S | ESH2-Z5 | 100086 | Aug.26, 2019 | Aug.25, 2020 |
| TEST RECEIVER | R&S | ESCI | 10096 | Jun.12, 2019 | Jun.11, 2020 |
| EXA Signal Analyzer | Aglient | N9010A | MY53470504 | Dec.18, 2019 | Dec.17, 2020 |
| Horn antenna | SCHWARZBECK | BBHA 9170 | #768 | Sep. 21, 2019 | Sep. 20, 2021 |
| preamplifier | ChengYi | EMC184045SE | 980508 | Sep. 23, 2019 | Sep. 22, 2020 |
| Double-Ridged Waveguide Horn | ETS LINDGREN | 3117 | 00034609 | May. 17, 2019 | May. 16, 2021 |
| Broadband Preamplifier | SCHWARZBECK | BBV 9718 | 9718-205 | Jun.12, 2019 | Jun.11, 2020 |
| ANTENNA | SCHWARZBECK | VULB9168 | D69250 | Sep.20, 2019 | Sep.19, 2020 |
| SIGNAL ANALYZER | Agilent | N9020A | MY52090123 | Sep. 09, 2019 | Sep. 08, 2020 |
| USB Wideband Power Sensor | Agilent | U2021XA | MY54110007 | Sep. 09, 2019 | Sep. 08, 2020 |
| Universal Radio Communication Tester | R&S | CMU200 | 120237 | July 13, 2019 | July 12, 2020 |
| Universal Radio Communication Tester | Agilent | 8960 | GB46200384 | July 11,2019 | July 10,2020 |
| Power Splitter | Agilent | 11636A | 34 | Jun.12, 2019 | Jun.11, 2020 |
| Attenuator | JFW | 50FHC-006-50 | N/A | Jun.12, 2019 | Jun.11, 2020 |
| Horn Ant (18G-40GHz) | Schwarzbeck | BBHA 9170 | | Sep. 21, 2019 | Sep. 20, 2021 |

| | | | | | |
|---|---|---|---|---|---|
| Horn Ant (18G-40GHz) | ETS | QWH_SL_18_40_K_SG | | Sep. 21, 2019 | Sep. 20, 2021 |
| Power Splitter | Agilent | 11636A | / | Sep.18, 2019 | Sep.17, 2020 |
| CMU200 | R&S | 120237 | / | July 13, 2019 | July 12, 2020 |
| Artificial Mains Network ENV216 | R&S | 101242 | / | July 11,2019 | July 10,2020 |
| Filter Bank Notch 1(880-915MHz) | MICRO-TRONICS | 010 | / | Feb. 27, 2019 | Feb. 26, 2020 |
| Filter Bank Notch 1(880-915MHz) | MICRO-TRONICS | 010 | / | Feb. 25, 2020 | Feb. 24, 2021 |
| Filter Bank Notch2 (1710-1785MHz) | MICRO-TRONICS | 009 | / | Feb. 27, 2019 | Feb. 26, 2020 |
| Filter Bank Notch2 (1710-1785MHz) | MICRO-TRONICS | 009 | / | Feb. 25, 2020 | Feb. 24, 2021 |
| Filter Bank Notch 3 (1920-1980MHz) | MICRO-TRONICS | 008 | / | Feb. 27, 2019 | Feb. 26, 2020 |
| Filter Bank Notch 3 (1920-1980MHz) | MICRO-TRONICS | 008 | / | Feb. 25, 2020 | Feb. 24, 2021 |

## 2.6 SPECIAL ACCESSORIES

The battery wassupplied by the applicant were used as accessories and being tested with EUT intended for FCC grant together.

## 2.7 EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

# 3. SYSTEM TEST CONFIGURATION

## 3.1 EUT CONFIGURATION

The EUTconfiguration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

## 3.2 EUT EXERCISE

The Transmitter was operated in the maximum output power mode through Communication Tester. The TX frequency was fixed which was for the purpose of the measurements.

## 3.3 CONFIGURATION OF EUT SYSTEM

Fig. 2-1 Configuration of EUT System

Table 2-1 Equipment Used in EUT System

| Item | Equipment | Model No. | ID or Specification | Remark |
|---|---|---|---|---|
| 1 | ALARM SYSTEM | X1 | FCC ID: 2AVZYX1 | EUT |
| 2 | Adapter | ICP12-120-1000D | DC 12V 1A | AE |
| 3 | Battery | N/A | DC 3.7V1000mAh | AE |
| 4 | USB Cable | N/A | N/A | AE |

***Note:All the accessories have been used during the test. The following "EUT" in setup diagram means EUT system.

## 4. SUMMARY OF TEST RESULTS

| Item Number | Item Description | | FCC Rules | Result |
|---|---|---|---|---|
| 1 | Output Power | Conducted Output Power | 2.1046 | Pass |
| | | Radiated Output Power | 22.913(a) (2) / 24.232 (c)/ 27.50(d)(4) | |
| 2 | Peak-to-Average Ratio | Peak-to-Average Ratio | 24.232(d) | Pass |
| 3 | Spurious Emission | Conducted Spurious Emission | 2.1051/22.917(a)/24.238(a)/ 27.53(h) | Pass |
| | | Radiated Spurious Emission | | |
| 4 | Frequency Stability | | 2.1053/22.917(a)/24.238(a)/27.53(h) | Pass |
| 5 | Occupied Bandwidth | | 2.1049 | Pass |
| 6 | Band Edge | | 2.1051/22.917(a)/24.238(a)/ 27.53(h) | Pass |

## 5. DESCRIPTION OF TEST MODES

During the testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication Tester (CMU 200)to ensure max power transmission and proper modulation. Three channels (The top channel, the middle channel and the bottom channel) were chosen for testing on both GSMand PCS frequency band.

*****Note:**GSM/GPRS 850, GSM/GPRS 1900, WCDMA/HSPA band II, WCDMA/HSPA band V, mode have been tested during the test.

The worst condition was recorded in the test report if no other modes test data.

# 6. OUTPUT POWER

## 6.1 CONDUCTED OUTPUT POWER

### 6.1.1 MEASUREMENT METHOD

The transmitter output port was connected to base station.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Measure the maximum burst average power and average power for othermodulation signal.

The EUT was setup for the max output power with pseudo random data modulation. Power was measured with Spectrum Analyzer. The measurements were performed on all modes(GSM/GPRS 850, GSM/GPRS 1900, WCDMA/HSPA band II, WCDMA/HSPA band V)at 3 typical channels(the Top Channel, the Middle Channel and the Bottom Channel) for each band.

GSM 850:

| Mode | Frequency (MHz) | Avg.Burst Power | Duty cycle Factor(dB) | Frame Power(dBm) |
|---|---|---|---|---|
| GPRS 850 (1 Slot) | 824.2 | 33.75 | -9 | 24.75 |
| | 836.6 | 33.66 | -9 | 24.66 |
| | 848.8 | 33.43 | -9 | 24.43 |
| GPRS 850 (2 Slot) | 824.2 | 31.25 | -6 | 25.25 |
| | 836.6 | 31.78 | -6 | 25.78 |
| | 848.8 | 31.85 | -6 | 25.85 |
| GPRS 850 (3 Slot) | 824.2 | 28.56 | -4.26 | 24.3 |
| | 836.6 | 28.67 | -4.26 | 24.41 |
| | 848.8 | 28.69 | -4.26 | 24.43 |
| GPRS 850 (4 Slot) | 824.2 | 26.38 | -3 | 23.38 |
| | 836.6 | 26.40 | -3 | 23.4 |
| | 848.8 | 26.35 | -3 | 23.35 |

| Mode | Channel | Frequency (MHz) | Avg.Burst Power (dBm) |
|---|---|---|---|
| EDGE (1 Slot) | 128 | 824.2 | 27.75 |
| | 190 | 836.6 | 27.69 |
| | 251 | 848.8 | 27.56 |
| EDGE (2 Slot) | 128 | 824.2 | 25.36 |
| | 190 | 836.6 | 25.26 |
| | 251 | 848.8 | 25.19 |
| EDGE (3 Slot) | 128 | 824.2 | 23.15 |
| | 190 | 836.6 | 23.21 |
| | 251 | 848.8 | 23.19 |
| EDGE (4 Slot) | 128 | 824.2 | 21.20 |
| | 190 | 836.6 | 21.23 |
| | 251 | 848.8 | 21.35 |

**PCS 1900:**

| Mode | Frequency (MHz) | Avg.Burst Power | Duty cycle Factor(dB) | Frame Power(dBm) |
|---|---|---|---|---|
| GPRS1900 (1 Slot) | 1850.2 | 28.75 | -9 | 19.75 |
| | 1880 | 27.91 | -9 | 18.91 |
| | 1909.8 | 27.09 | -9 | 18.09 |
| GPRS 1900 (2 Slot) | 1850.2 | 26.85 | -6 | 20.85 |
| | 1880 | 25.82 | -6 | 19.82 |
| | 1909.8 | 25.06 | -6 | 19.06 |
| GPRS 1900 (3 Slot) | 1850.2 | 24.96 | -4.26 | 20.70 |
| | 1880 | 24.93 | -4.26 | 20.67 |
| | 1909.8 | 24.86 | -4.26 | 20.60 |
| GPRS 1900 (4 Slot) | 1850.2 | 23.19 | -3 | 20.19 |
| | 1880 | 23.30 | -3 | 20.30 |
| | 1909.8 | 23.22 | -3 | 20.22 |

| Mode | Channel | Frequency (MHz) | Avg.Burst Power (dBm) |
|---|---|---|---|
| EDGE (1 Slot) | 512 | 1850.2 | 24.90 |
| | 661 | 1880 | 24.04 |
| | 810 | 1909.8 | 23.14 |
| EDGE (2 Slot) | 512 | 1850.2 | 22.86 |
| | 661 | 1880 | 22.71 |
| | 810 | 1909.8 | 22.65 |
| EDGE (3 Slot) | 512 | 1850.2 | 21.30 |
| | 661 | 1880 | 21.35 |
| | 810 | 1909.8 | 21.40 |
| EDGE (4 Slot) | 512 | 1850.2 | 20.23 |
| | 661 | 1880 | 20.35 |
| | 810 | 1909.8 | 20.40 |

**UMTS BAND V**

| Mode | Frequency (MHz) | Reference power | Avg.Burst Power |
|---|---|---|---|
| WCDMA 850 RMC | 826.4 | 24 | 23.75 |
| | 836.4 | 24 | 24.42 |
| | 846.6 | 24 | 24.61 |
| WCDMA850 AMR | 826.4 | 24 | 23.35 |
| | 836.4 | 24 | 23.52 |
| | 846.6 | 24 | 23.46 |
| HSDPA Subtest 1 | 826.4 | 24 | 24.01 |
| | 836.4 | 24 | 24.60 |
| | 846.6 | 24 | 24.67 |
| HSDPA Subtest 2 | 826.4 | 24 | 22.94 |
| | 836.4 | 24 | 23.35 |
| | 846.6 | 24 | 22.53 |
| HSDPA Subtest 3 | 826.4 | 24 | 23.41 |
| | 836.4 | 24 | 23.37 |
| | 846.6 | 24 | 22.39 |
| HSDPA Subtest 4 | 826.4 | 24 | 23.34 |
| | 836.4 | 24 | 22.32 |
| | 846.6 | 24 | 22.45 |

**UMTS BAND II**

| Mode | Frequency (MHz) | Reference power | Avg.Burst Power |
|---|---|---|---|
| WCDMA 1900 RMC | 1852.4 | 24 | 21.04 |
| | 1880 | 24 | 22.00 |
| | 1907.6 | 24 | 22.58 |
| WCDMA1900 AMR | 1852.4 | 24 | 20.56 |
| | 1880 | 24 | 21.36 |
| | 1907.6 | 24 | 21.51 |
| HSDPA Subtest 1 | 1852.4 | 24 | 21.48 |
| | 1880 | 24 | 22.13 |
| | 1907.6 | 24 | 22.44 |
| HSDPA Subtest 2 | 1852.4 | 24 | 19.53 |
| | 1880 | 24 | 20.69 |
| | 1907.6 | 24 | 21.44 |
| HSDPA Subtest 3 | 1852.4 | 24 | 19.45 |
| | 1880 | 24 | 20.67 |
| | 1907.6 | 24 | 21.38 |
| HSDPA Subtest 4 | 1852.4 | 24 | 18.26 |
| | 1880 | 24 | 19.50 |
| | 1907.6 | 24 | 20.31 |

According to 3GPP 25.101 sub-clause 6.2.2 , the maximum output power is allowed to be reduced by following the table.

Table 6.1aA: UE maximum output power with HS-DPCCH and E-DCH

| UE Transmit Channel Configuration | CM(db) | MPR(db) |
|---|---|---|
| For all combinations of ,DPDCH,DPCCH HS-DPDCH,E-DPDCH and E-DPCCH | 0≤ CM≤3.5 | MAX(CM-1,0) |
| Note: CM=1 for $\beta_c/\beta_d$=12/15, $\beta_{hs}/\beta_c$=24/15.For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference. | | |

The device supports MPR to solve linearity issues (ACLR or SEM) due to the higher peak-to average ratios (PAR) of the HSUPA signal. This prevents saturating the full range of the TX DAC inside of device and provides a reduced power output to the RF transceiver chip according to the Cubic Metric (a function of the combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH).

When E-DPDCH channels are present the beta gains on those channels are reduced firsts to try to get the power under the allowed limit. If the beta gains are lowered as far as possible, then a hard limiting is applied at the maximum allowed level.

The SW currently recalculates the cubic metric every time the beta gains on the E-DPDCH are reduced. The cubic metric will likely get lower each time this is done .However, there is no reported reduction of maximum output power in the HSUPA mode since the device also provides a compensate for the power back-off by increasing the gain of TX_AGC in the transceiver (PA) device.

The end effect is that the DUT output power is identical to the case where there is no MPR in the device.

## 6.2 RADIATED OUTPUT POWER

### 6.2.1 MEASUREMENT METHOD

The measurements procedures specified in ANSI/TIA-603-E-2016were applied.

1. Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signal operating below 1GHz are performed using dipole antennas. Measurements on signals operating above 1GHz are performed using broadband horn antennas. All measurements are performed as RMS average measurements while the EUT operating at its maximum duty cycle, at maximum power, and at the approximate frequencies.
2. In an anechoic antenna test chamber, a half-wave dipole antenna for the frequency band of interest is placed at the reference centre of the chamber. An RF Signal source for the frequency band of interest is connected to the dipole with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A known (measured) power (Pin) is applied to the input of the dipole, and the power received (Pr) at the chamber's probe antenna is recorded.
3. The substitution method is used. Substitution values at each frequency are measured before and saved to the test software. A "reference path loss" is established as ARpl=Pin + 2.15 - Pr. TheARpl is the attenuation of “reference path loss”, and including the gain of receive antenna, the cable loss and the air loss. The measurement results are obtained as described below: Power=PMea+ARpl
4. The EUT is substituted for the dipole at the reference centre of the chamber and a scan is performed to obtain the radiation pattern.
5. From the radiation pattern, the co-ordinates where the maximum antenna gain occurs are identified.
6. The EUT is then put into continuously transmitting mode at its maximum power level.
7. Power mode measurements are performed with the receiving antenna placed at the coordinates determined in Step 3 to determine the output power as defined in Rule 24.232 (b) and (c). The "reference path loss" from Step1 is added to this result.
8. This value is EIRP since the measurement is calibrated using a half-wave dipole antenna of known gain (2.15 dBi) and known input power (Pin).
9. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi...

### 6.2.2 PROVISIONS APPLICABLE

| Mode | FCC Part Section(s) | Nominal Peak Power |
|---|---|---|
| GSM/GPRS 850 | 22.913(a)(2) | <=38.45dBm (7W). ERP |
| GSM/GPRS 1900 | 24.232(c) | <=33dBm (2W). EIRP |
| UMTS BAND II | 24.232(c) | <=33dBm (2W),EIRP |
| UMTS BANDV | 22.913(a)(2) | <=38.45dBm (7W).ERP |

### 6.2.3 MEASUREMENT RESULT

| Radiated Power (ERP) for GSM/GPRS 850 | | | | |
|---|---|---|---|---|
| Mode | Frequency | Result | | Conclusion |
| | | Max. Peak ERP (dBm) | Polarization Of Max. ERP | |
| GPRS | 824.2 | 30.16 | Horizontal | Pass |
| | 836.6 | 30.22 | Horizontal | Pass |
| | 848.8 | 30.15 | Horizontal | Pass |
| | 824.2 | 29.56 | Vertical | Pass |
| | 836.6 | 29.57 | Vertical | Pass |
| | 848.8 | 29.49 | Vertical | Pass |

| Radiated Power (E.I.R.P) for GSM/GPRS 1900 | | | | |
|---|---|---|---|---|
| Mode | Frequency | Result | | Conclusion |
| | | Max. Peak E.I.R.P.(dBm) | Polarization Of Max. E.I.R.P. | |
| GPRS | 1850.2 | 27.52 | Horizontal | Pass |
| | 1880.0 | 27.63 | Horizontal | Pass |
| | 1909.8 | 27.43 | Horizontal | Pass |
| | 1850.2 | 26.36 | Vertical | Pass |
| | 1880.0 | 26.25 | Vertical | Pass |
| | 1909.8 | 26.20 | Vertical | Pass |

| Radiated Power (ERP) for GSM/EDGE 850 | | | | |
|---|---|---|---|---|
| Mode | Frequency | Result | | Conclusion |
| | | Max. Peak ERP (dBm) | Polarization Of Max. ERP | |
| EDGE | 824.2 | 26.95 | Horizontal | Pass |
| | 836.6 | 26.88 | Horizontal | Pass |
| | 848.8 | 26.75 | Horizontal | Pass |
| | 824.2 | 25.02 | Vertical | Pass |
| | 836.6 | 25.03 | Vertical | Pass |
| | 848.8 | 25.12 | Vertical | Pass |

| Radiated Power (E.I.R.P) for GSM/EDGE 1900 | | | | |
|---|---|---|---|---|
| Mode | Frequency | Result | | Conclusion |
| | | Max. Peak E.I.R.P.(dBm) | Polarization Of Max. E.I.R.P. | |
| EDGE | 1850.2 | 24.28 | Horizontal | Pass |
| | 1880.0 | 24.36 | Horizontal | Pass |
| | 1909.8 | 24.60 | Horizontal | Pass |
| | 1850.2 | 23.11 | Vertical | Pass |
| | 1880.0 | 23.10 | Vertical | Pass |
| | 1909.8 | 23.23 | Vertical | Pass |

| Radiated Power (E.I.R.P) for UMTS band II | | | | |
|---|---|---|---|---|
| Mode | Frequency | Result | | Conclusion |
| | | Max. Peak E.I.R.P (dBm) | Polarization Of Max. E.I.R.P | |
| UMTS | 1852.4 | **21.52** | Horizontal | Pass |
| | 1880 | 21.35 | Horizontal | Pass |
| | 1907.6 | 21.30 | Horizontal | Pass |
| | 1852.4 | 20.02 | Vertical | Pass |
| | 1880 | 20.09 | Vertical | Pass |
| | 1907.6 | 20.13 | Vertical | Pass |

| Radiated Power (ERP) for UMTS band V | | | | |
|---|---|---|---|---|
| Mode | Frequency | Result | | Conclusion |
| | | Max. Peak ERP (dBm) | Polarization Of Max. ERP | |
| UMTS | 826.4 | 23.82 | Horizontal | Pass |
| | 836.4 | 23.66 | Horizontal | Pass |
| | 846.6 | **23.69** | Horizontal | Pass |
| | 826.4 | 21.20 | Vertical | Pass |
| | 836.4 | 21.36 | Vertical | Pass |
| | 846.6 | 21.41 | Vertical | Pass |

Note: Above is the worst mode data.

## 6.3. PEAK-TO-AVERAGE RATIO

### 6.3.1 MEASUREMENT METHOD

Use one of the procedures presented in 4.1 to measure the total peak power and record as PPk. Use one of the applicable procedures presented 4.2 to measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

PAPR (dB) = PPk (dBm) - PAvg (dBm).

### 6.3.2 PROVISIONS APPLICABLE

This is the test for the Peak-to-Average Ratio from the EUT.

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

### 6.3.3 MEASUREMENT RESULT

| Modes | GSM850(GPRS) | | |
|---|---|---|---|
| Channel | 128 | 190 | 251 |
| | (Low) | (Mid) | (High) |
| Frequency (MHz) | 824.2 | 836.6 | 848.8 |
| Peak-To-Average Ratio (dB)/GPRS | 11.18 | 11.18 | 10.97 |

| Modes | PCS1900 (GPRS) | | |
|---|---|---|---|
| Channel | 512 | 661 | 810 |
| | (Low) | (Mid) | (High) |
| Frequency (MHz) | 1850.2 | 1880 | 1909.8 |
| Peak-To-Average Ratio (dB)/GPRS | 10.91 | 11.01 | 11.17 |

| Modes | UMTS BAND II | | |
|---|---|---|---|
| Channel | 9262 | 9400 | 9538 |
| | (Low) | (Mid) | (High) |
| Frequency (MHz) | 1852.4 | 1880 | 1907.6 |
| Peak-To-Average Ratio (dB) | 4.83 | 4.23 | 4.16 |

| Modes | UMTS BAND V | | |
|---|---|---|---|
| Channel | 4132 | 4182 | 4233 |
| | (Low) | (Mid) | (High) |
| Frequency (MHz) | 826.4 | 836.4 | 846.6 |
| Peak-To-Average Ratio (dB) | 4.62 | 4.14 | 4.51 |

# 7. OCCUPIED BANDWIDTH

## 7.1 MEASUREMENT METHOD

1. The Occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper Frequency limits, the mean power radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

2. RBW=1~5% of the expected OBW, VBW>=3 x RBW, Detector=Peak, Trace mode=max hold, Sweep=auto couple, and the trace was allowed to stabilize.

## 7.2 PROVISIONS APPLICABLE

The emission bandwidth is defined as two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26dB below the transmitter power

## 7.3 MEASUREMENT RESULT

**Test Results**

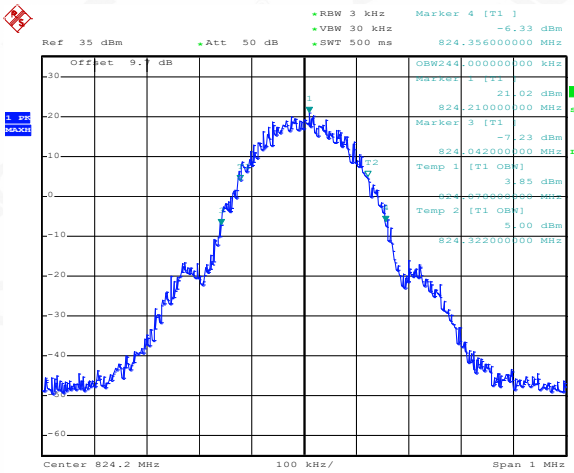
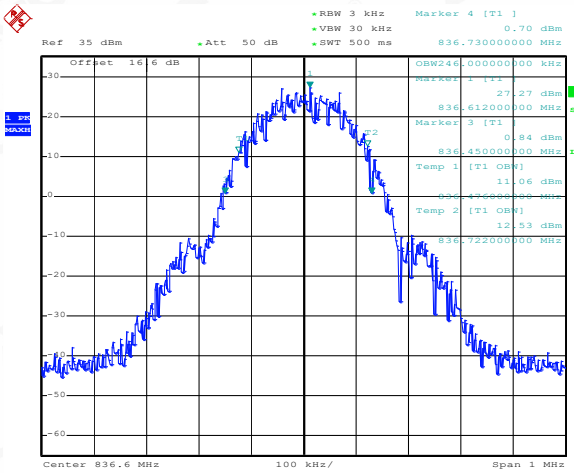
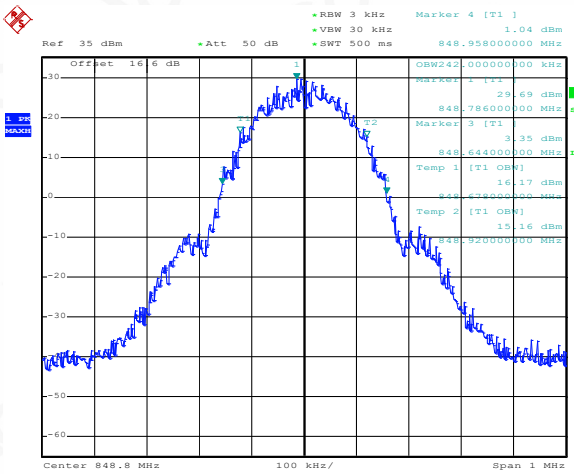
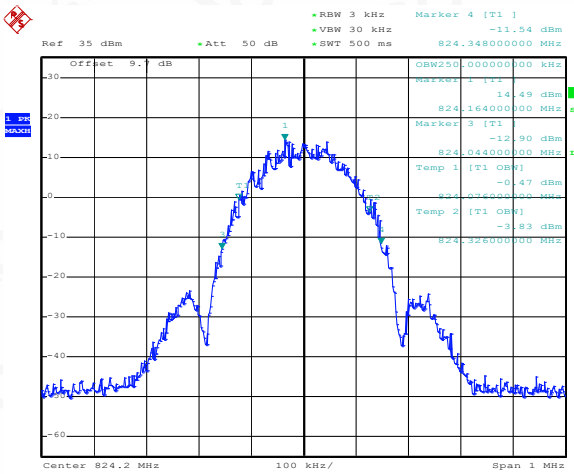
| Test Band | Test Mode | Test Channel | Occupied Bandwidth (KHZ) | Emission Bandwidth (KHZ) | Verdict |
|---|---|---|---|---|---|
| GSM 850 | GPRS | LCH | 244.0 | 314 | PASS |
| | | MCH | 246.0 | 280 | PASS |
| | | HCH | 242.0 | 314 | PASS |
| | EGPRS | LCH | 250.0 | 304 | PASS |
| | | MCH | 244.0 | 306 | PASS |
| | | HCH | 242.0 | 304 | PASS |

| Test Band | Test Mode | Test Channel | Occupied Bandwidth (KHZ) | Emission Bandwidth (KHZ) | Verdict |
|---|---|---|---|---|---|
| PCS 1900 | GPRS | LCH | 244.0 | 304 | PASS |
| | | MCH | 242.0 | 28 | PASS |
| | | HCH | 244.0 | 314 | PASS |
| | EGPRS | LCH | 246.0 | 298 | PASS |
| | | MCH | 248.0 | 298 | PASS |
| | | HCH | 244.0 | 300 | PASS |

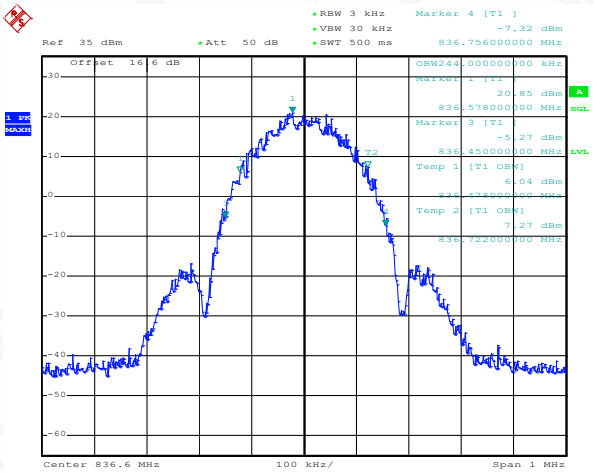
## For GSM

### Test Band=GSM 850/PCS1900

### Test Mode= GSM/EGPRS

| GSM 850-LCH-GSM | GSM 850-MCH-GSM |
|---|---|
|  |  |
| AAA<br>Date: 9.JAN.2020 15:00:18 | AAA<br>Date: 9.JAN.2020 15:00:51 |
| **GSM 850-HCH-GSM** | **GSM 850-LCH-EGPRS** |
|  |  |
| AAA<br>Date: 9.JAN.2020 15:01:30 | AAA<br>Date: 9.JAN.2020 15:02:39 |

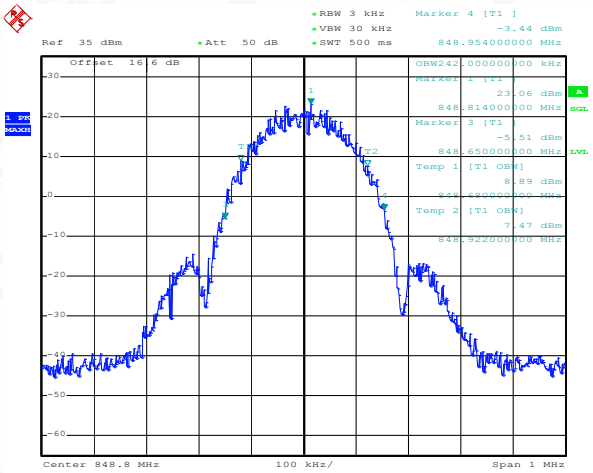
## GSM 850-MCH- EGPRS




AAA

Date: 9.JAN.2020 15:03:20

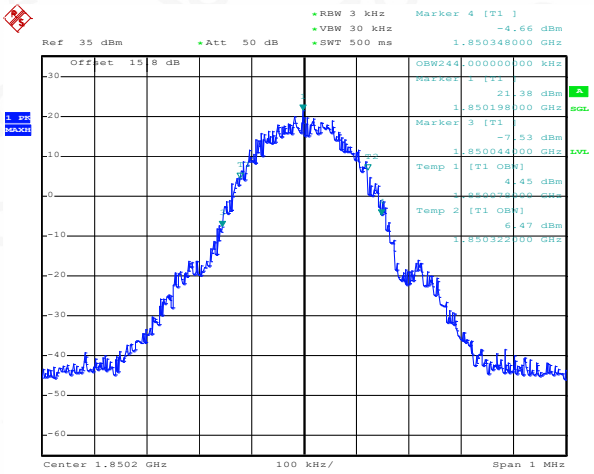
## GSM 850-HCH- EGPRS




AAA

Date: 9.JAN.2020 15:03:58

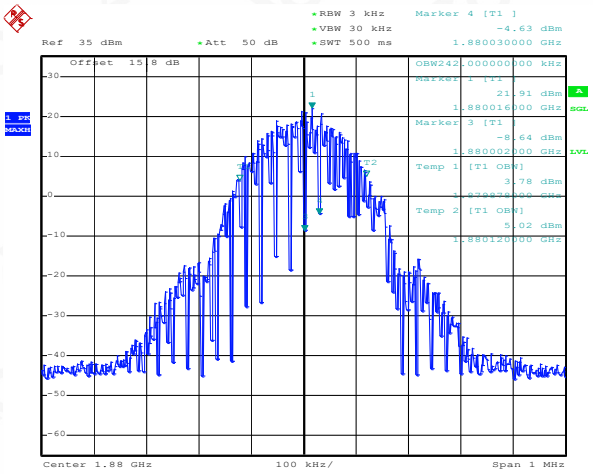
## GSM 1900-LCH-GSM




AAA

Date: 9.JAN.2020 13:31:04

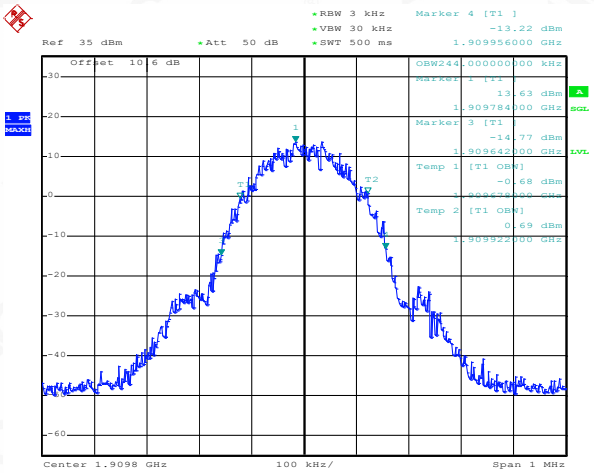
## GSM 1900-MCH-GSM




AAA

Date: 9.JAN.2020 13:31:33

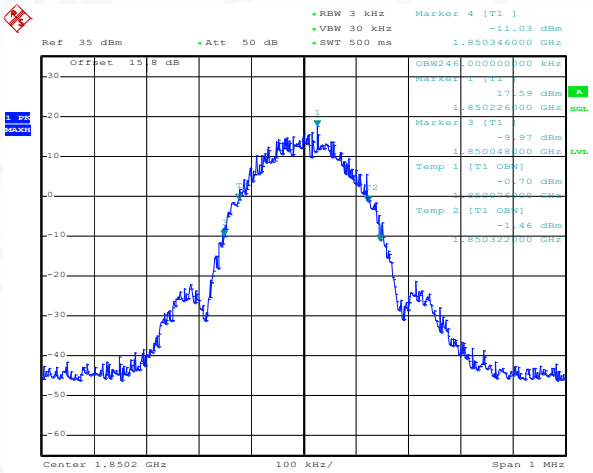
## GSM 1900-HCH-GSM




AAA

Date: 9.JAN.2020 13:32:02

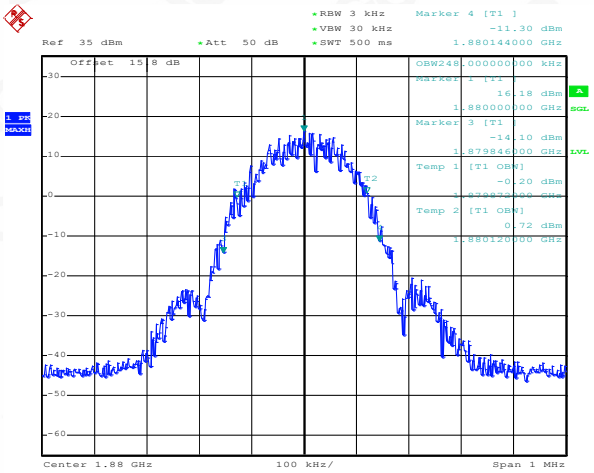
## GSM 1900-LCH-EGPRS




AAA

Date: 9.JAN.2020 15:12:12

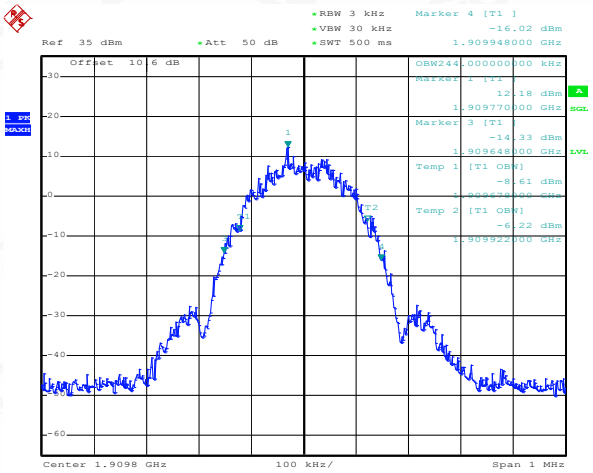
## GSM 1900-MCH- EGPRS




AAA

Date: 9.JAN.2020 15:12:47

## GSM 1900-HCH- EGPRS




AAA

Date: 9.JAN.2020 15:13:18

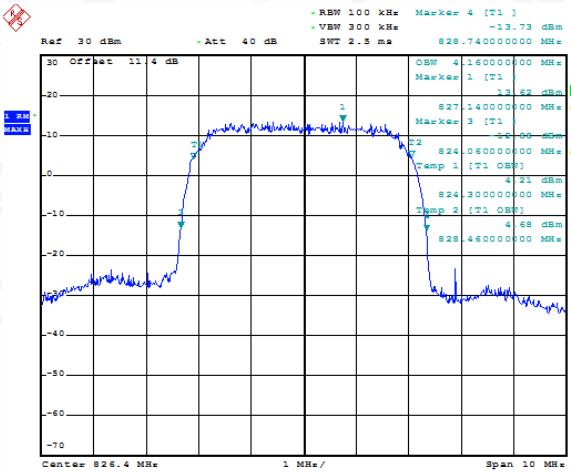
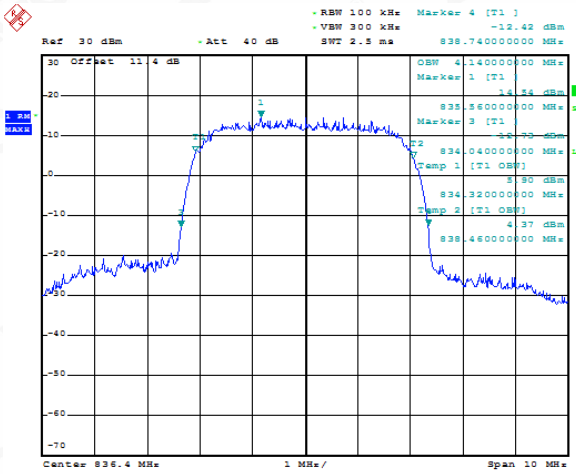
| Test Band | Test Mode | Test Channel | Occupied Bandwidth (KHZ) | Emission Bandwidth (KHZ) | Verdict |
|---|---|---|---|---|---|
| WCDMA 850 | UMTS | LCH | 4160.0 | 4680 | PASS |
| | | MCH | 4140.0 | 4700 | PASS |
| | | HCH | 4100.0 | 4680 | PASS |

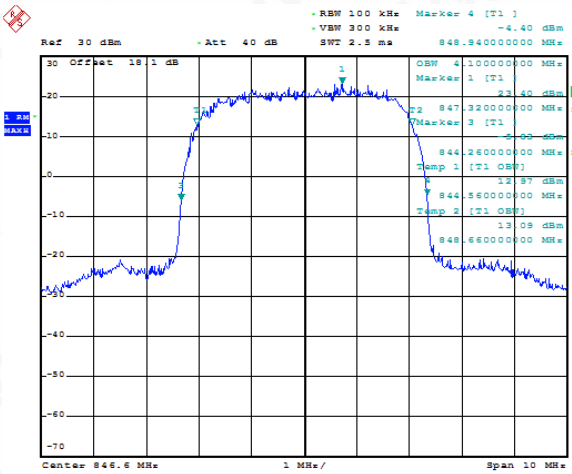
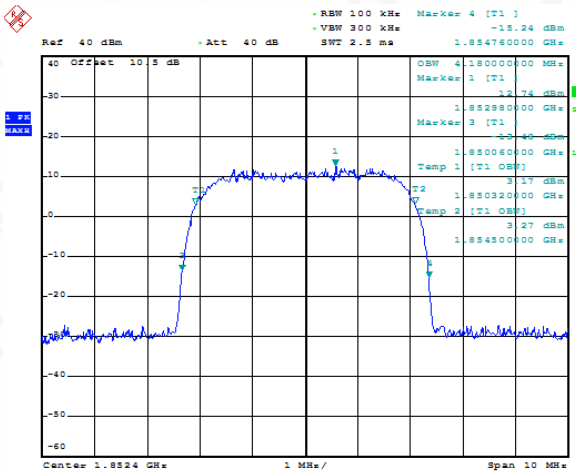
| Test Band | Test Mode | Test Channel | Occupied Bandwidth (KHZ) | Emission Bandwidth (KHZ) | Verdict |
|---|---|---|---|---|---|
| WCDMA 1900 | UMTS | LCH | 4160.0 | 4700 | PASS |
| | | MCH | 4180.0 | 4720 | PASS |
| | | HCH | 4180.0 | 4720 | PASS |

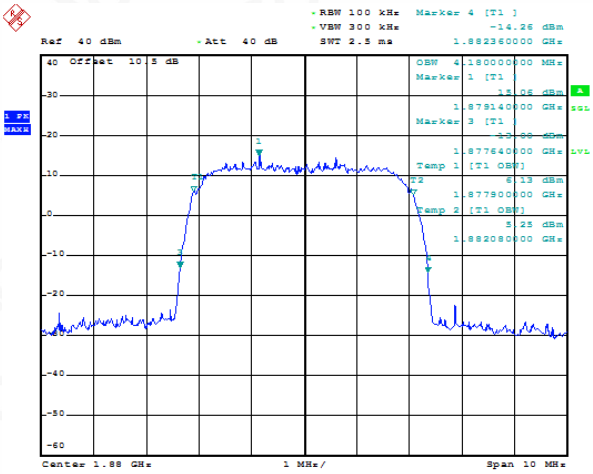
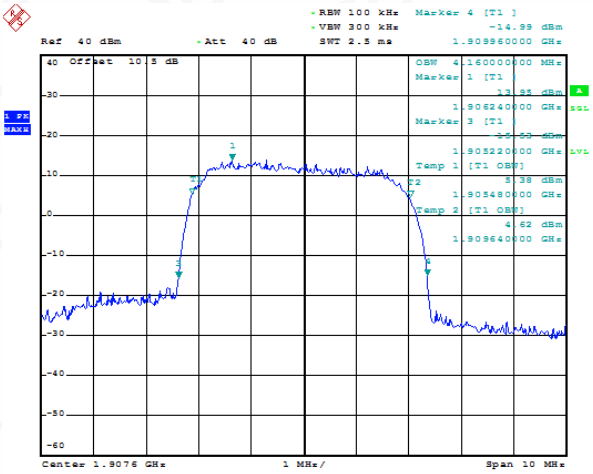
**For WCDMA**

**Test Band=WCDMA850/WCDMA1900**

**Test Mode=UMTS**

| WCDMA 850-LCH | WCDMA 850-MCH |
|---|---|
|  |  |
| AAA<br>Date: 9.JAN.2020 10:09:24 | AAA<br>Date: 9.JAN.2020 10:09:47 |

| WCDMA 850-HCH | WCDMA 1900-LCH |
|---|---|
|  |  |
| AAA<br>Date: 9.JAN.2020 10:10:10 | AAA<br>Date: 9.JAN.2020 09:12:34 |

| WCDMA 1900-MCH | WCDMA 1900-HCH |
|---|---|
|  |  |
| AAA<br>Date: 9.JAN.2020 09:12:57 | AAA<br>Date: 9.JAN.2020 09:13:20 |

# 8. BAND EDGE

## 8.1 MEASUREMENT METHOD

1. All out of band emissions are measured with an analyzer spectrum connected to the antenna terminal of the EUT while the EUT at its maximum duty cycle, at maximum power, and at the approximate frequencies. All data rates were investigated to determine the worst case configuration
2. The test set up and general procedure is similar to conducted peak output power test. Only different for setting the measurement configuration of the measuring instrument of Spectrum Analyzer.
3. Start and stop frequency were set such that the band edge would be placed in the center of the plot.
4. Span was set large enough so as to capture all out of band emissions near the band edge.
5. RBW>1% of the emission bandwidth, VBW >=3 x RBW, Detector=RMS, Number of points>=2 x Span/RBW, Trace mode=max hold, Sweep time=auto couple, and the trace was allowed to stabilize

## 8.2 PROVISIONS APPLICABLE

As Specified in FCC rules of 22.917(a) 、24.238(a)and KDB 971168 D1 V03R01.

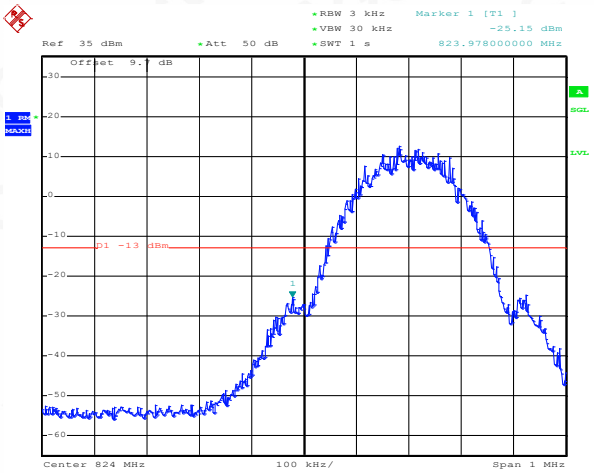
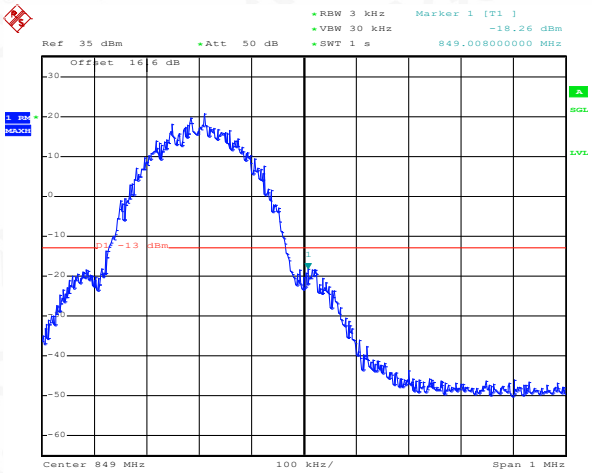
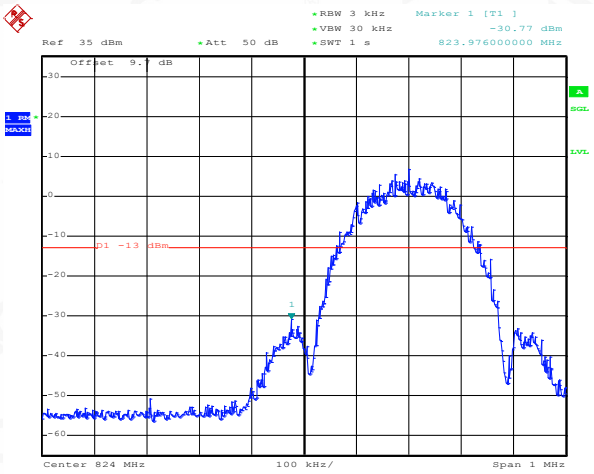
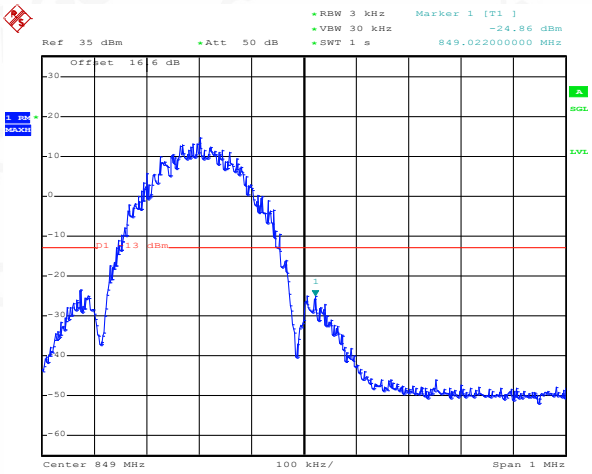
## 8.3 MEASUREMENT RESULT

**Test Results**

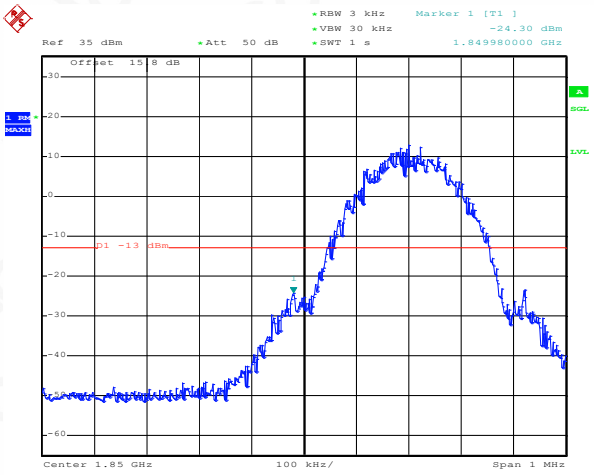
**For GSM**

**Test Band=GSM 850/PCS 1900**

**Test Mode=GSM/EGPRS**

| GSM 850-LCH-GSM | GSM 850-HCH-GSM |
|---|---|
|   AAA<br>Date: 9.JAN.2020 11:00:40 |   AAA<br>Date: 9.JAN.2020 11:01:16 |
| **GSM 850-LCH-EDGE** | **GSM 850-HCH-EDGE** |
|   AAA<br>Date: 9.JAN.2020 12:00:44 |   AAA<br>Date: 9.JAN.2020 12:01:20 |

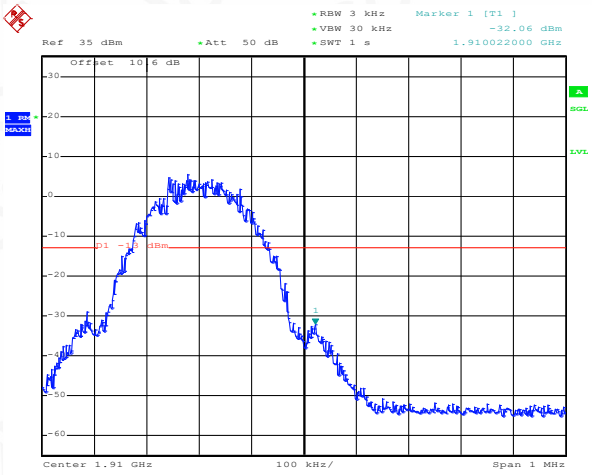
## PCS 1900-LCH-GSM




AAA

Date: 9.JAN.2020 13:32:45

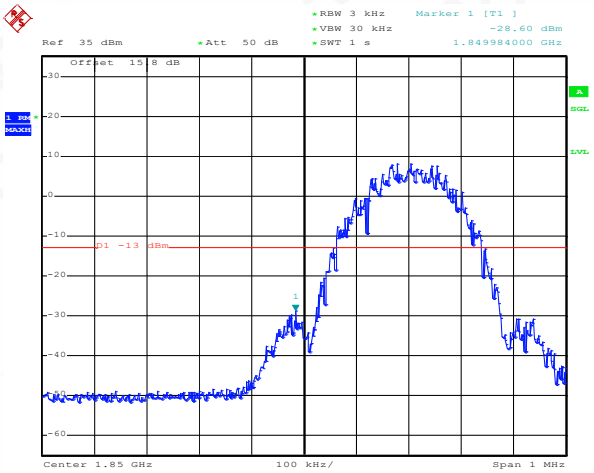
## PCS 1900-HCH-GSM




AAA

Date: 9.JAN.2020 13:33:21

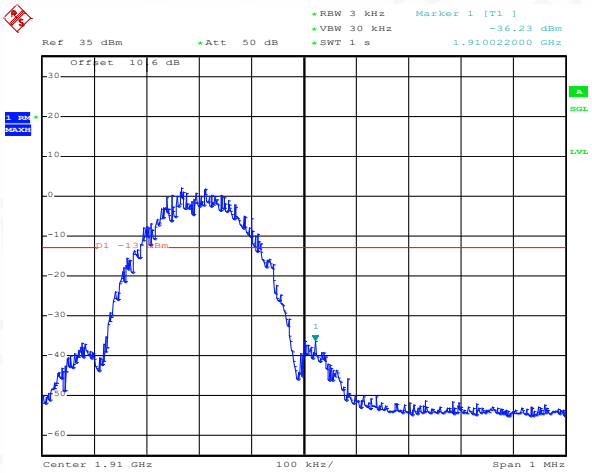
## PCS 1900-LCH-EDGE




AAA

Date: 9.JAN.2020 14:01:11

## PCS 1900-HCH-EDGE



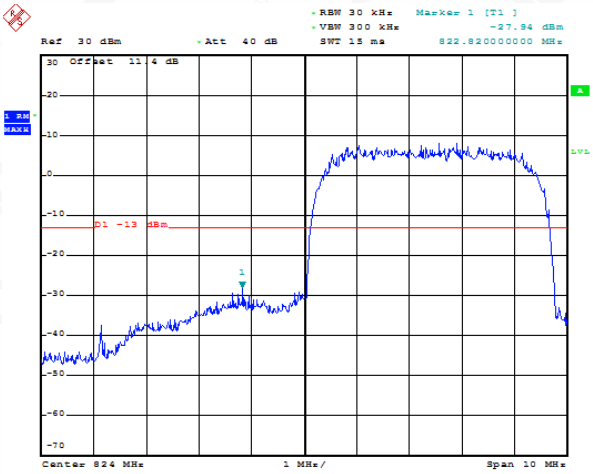
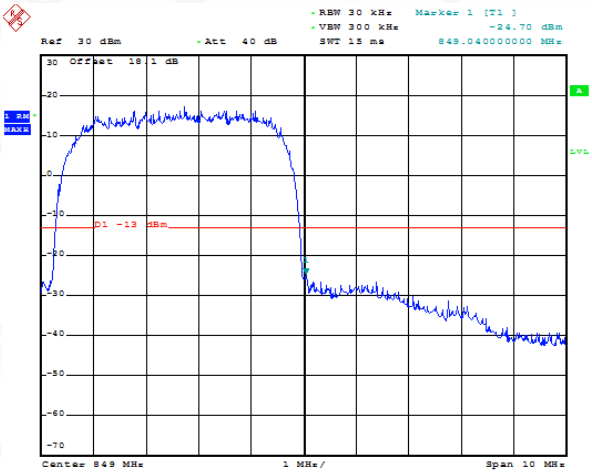
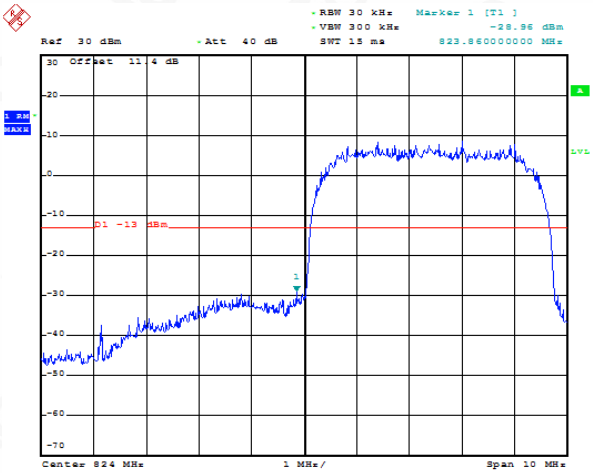
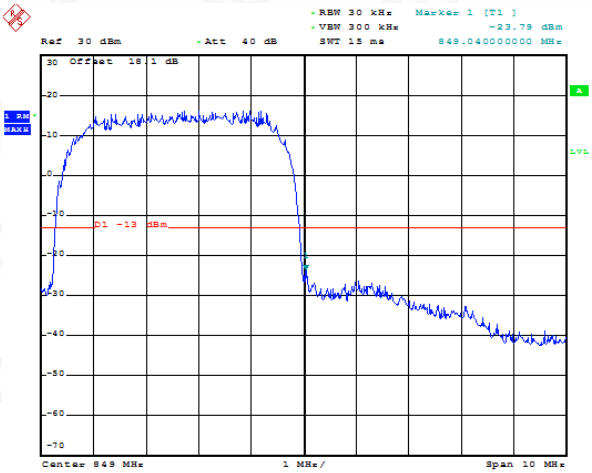

AAA

Date: 9.JAN.2020 14:01:47

**For WCDMA**

**Test Band=WCDMA850/WCDMA1900**

**Test Mode=UMTS**

| WCDMA 850-LCH | WCDMA 850-HCH |
|---|---|
|   AAA Date: 9.JAN.2020 10:10:40 |   AAA Date: 9.JAN.2020 10:10:55 |
| **WCDMA 1900-LCH** | **WCDMA 1900-HCH** |
|   AAA Date: 9.JAN.2020 10:36:46 |   AAA Date: 9.JAN.2020 10:37:48 |

# 9. SPURIOUS EMISSION

## 9.1 CONDUCTED SPURIOUS EMISSION

### 9.1.1MEASUREMENT METHOD

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. The level of the carrier and the various conducted spurious and harmonic frequency 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 $10^{th}$ harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the approximate frequencies. All data rates were investigated to determine the worst case configuration.

2. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of PCS1900 band, this equates to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For GSM850, data taken from 30 MHz to 9 GHz.

3. Determine EUT transmit frequencies: the following typical channelswere chosen to conducted emissions testing.

| Typical Channels for testing of GSM 850 | |
|---|---|
| Channel | Frequency (MHz) |
| 128 | 824.2 |
| 190 | 836.6 |
| 251 | 848.8 |

| Typical Channels for testing of PCS 1900 | |
|---|---|
| Channel | Frequency (MHz) |
| 512 | 1850.2 |
| 661 | 1880.0 |
| 810 | 1909.8 |

| Typical Channels for testing of UMTS band II | |
|---|---|
| Channel | Frequency (MHz) |
| 9262 | 1852.4 |
| 9400 | 1880 |
| 9538 | 1907.6 |

| Typical Channels for testing of UMTS band V | |
|---|---|
| Channel | Frequency (MHz) |
| 4132 | 826.4 |
| 4182 | 836.4 |
| 4233 | 846.6 |

### 9.1.2 PROVISIONS APPLICABLE

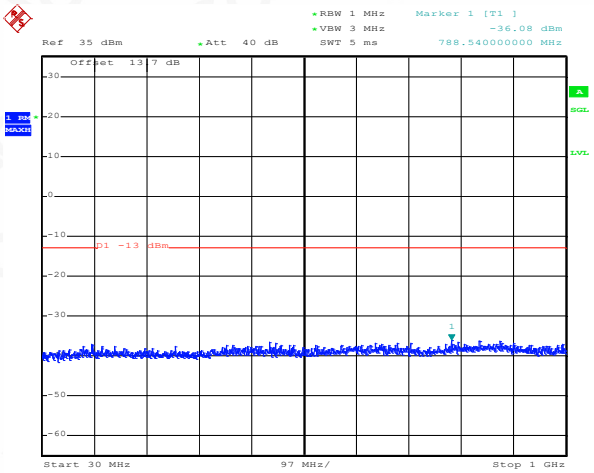
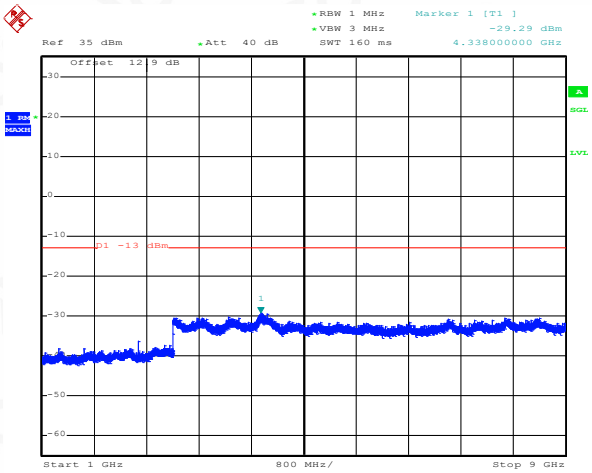
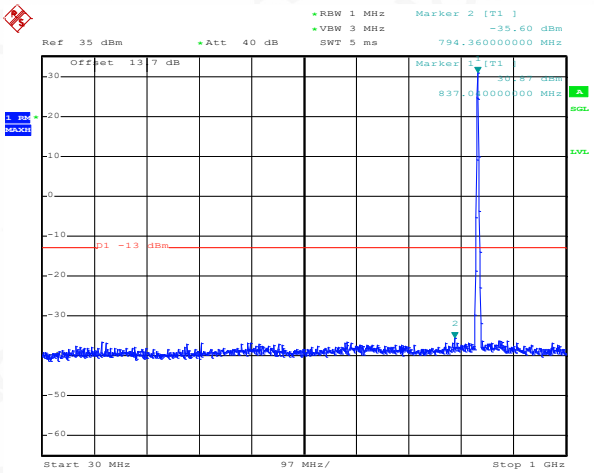
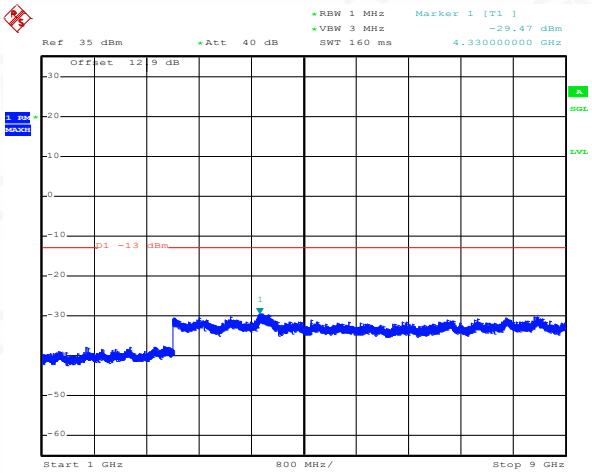
On any frequency outside frequency band of the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

### 9.1.3MEASUREMENT RESULT

**Test Results**

**Test Band=GSM 850/PCS1900**

**Test Mode=GSM/EGPRS**

| GSM 850-LCH | GSM 850-LCH |
|---|---|
|  |  |
| AAA<br>Date: 9.JAN.2020 11:09:43 | AAA<br>Date: 9.JAN.2020 11:09:52 |
| **GSM 850-MCH** | **GSM 850-MCH** |
|  |  |
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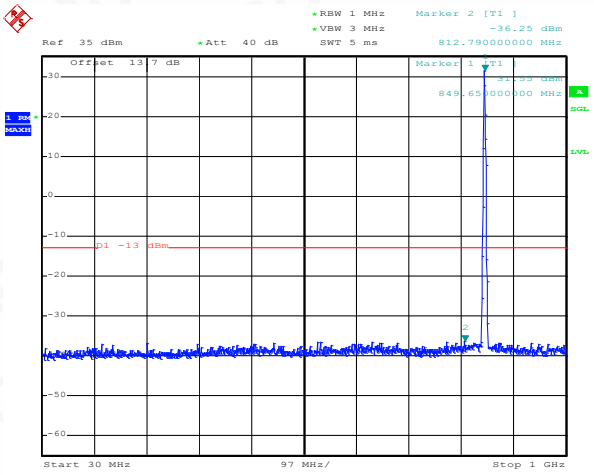


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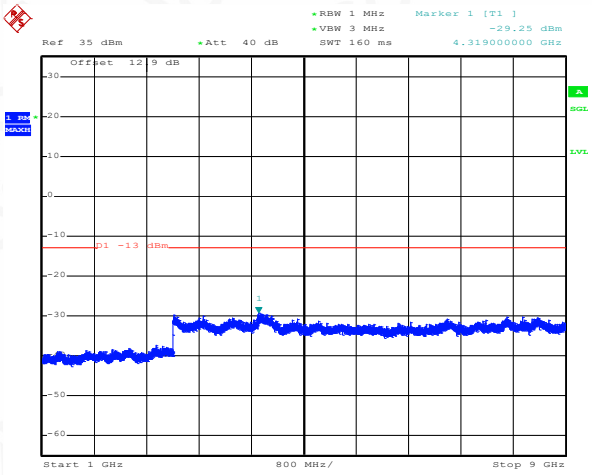
Date: 9.JAN.2020 11:11:52

## GSM 850-HCH

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Date: 9.JAN.2020 11:12:01

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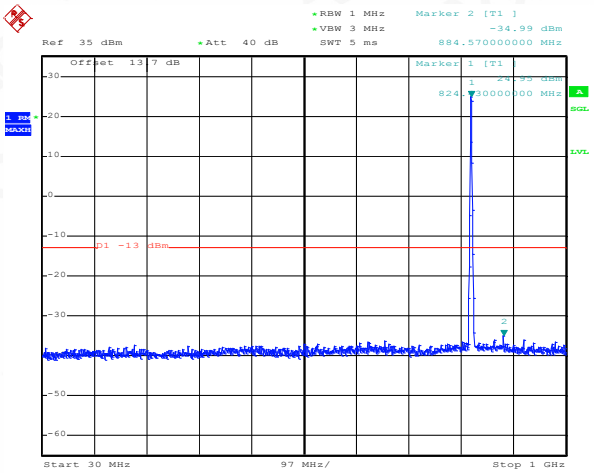


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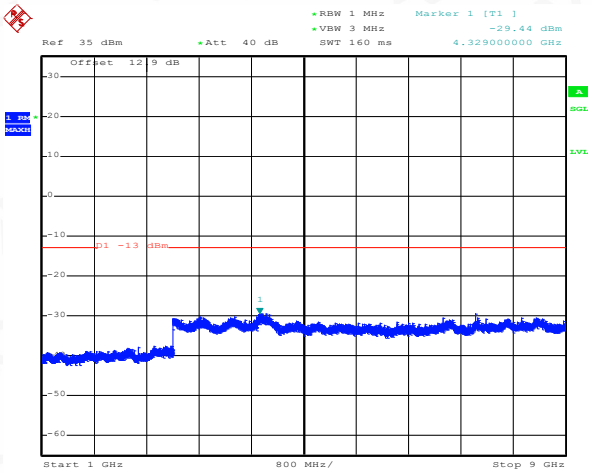
Date: 9.JAN.2020 14:11:17

## GSM 850-LCH- EDGE

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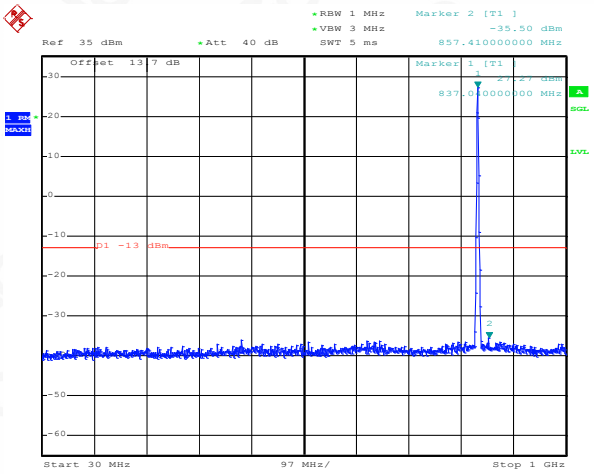
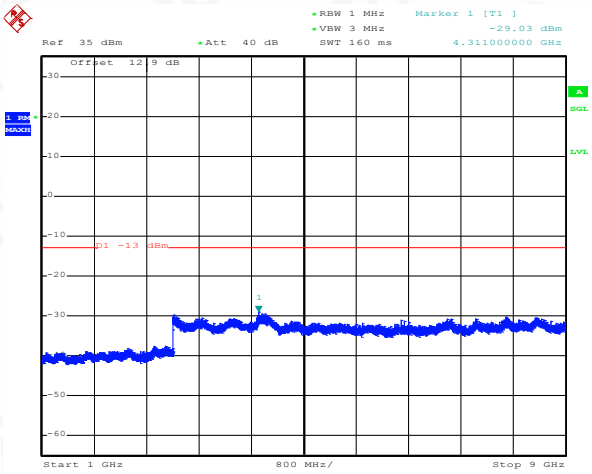
Date: 9.JAN.2020 14:11:27

| GSM 850-MCH-EDGE | GSM 850-MCH-EDGE |
|---|---|
|   AAA<br>Date: 9.JAN.2020 14:12:31 |   AAA<br>Date: 9.JAN.2020 14:12:41 |
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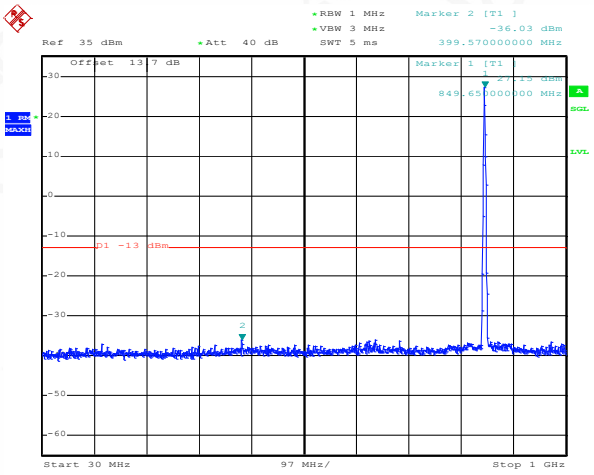
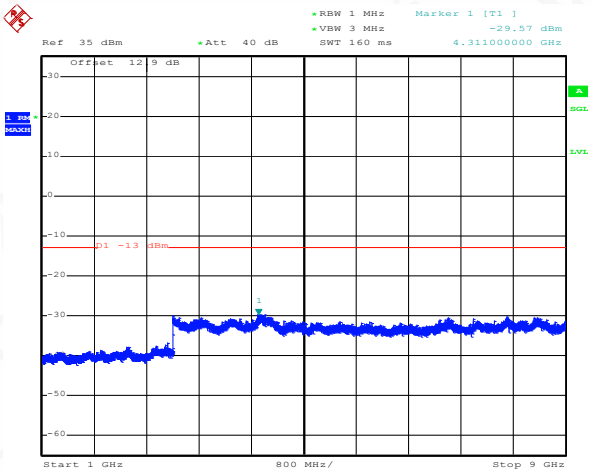
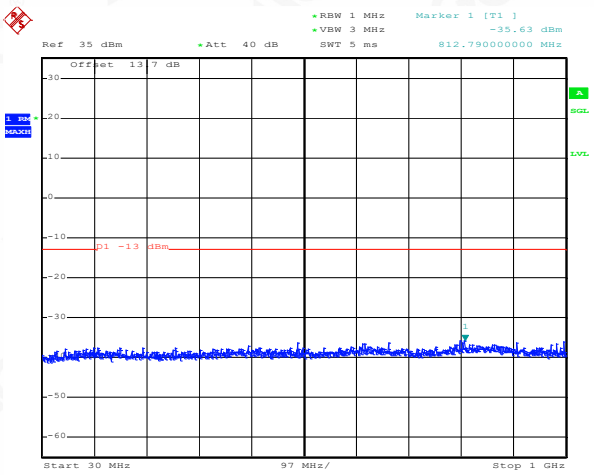
|   AAA<br>Date: 9.JAN.2020 14:13:41 |   AAA<br>Date: 9.JAN.2020 14:13:51 |
| PCS 1900-LCH | PCS 1900-LCH |

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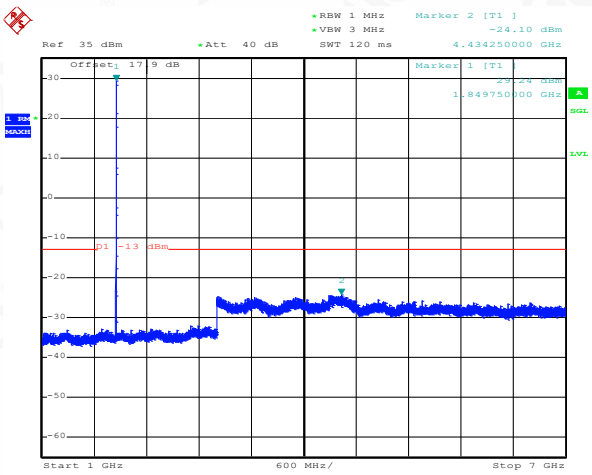
Date: 9.JAN.2020 13:34:20

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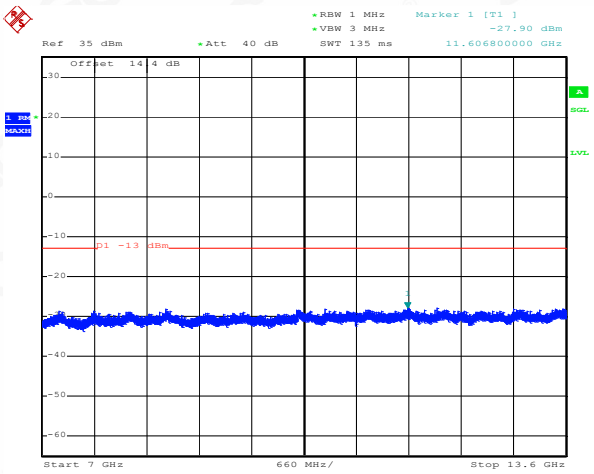


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Date: 9.JAN.2020 13:34:40

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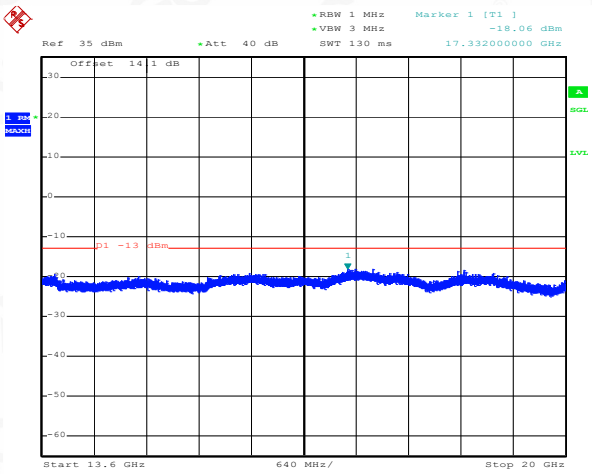


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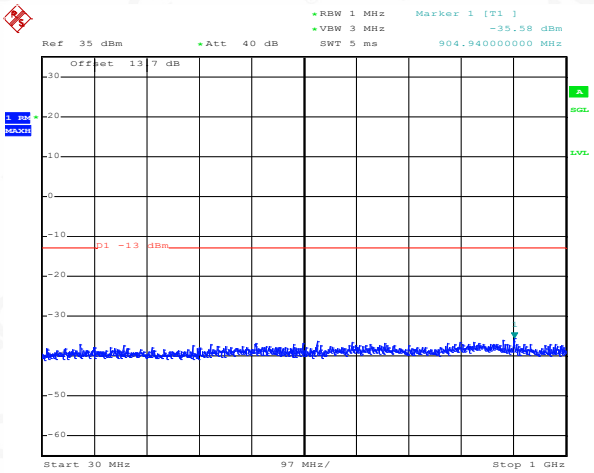


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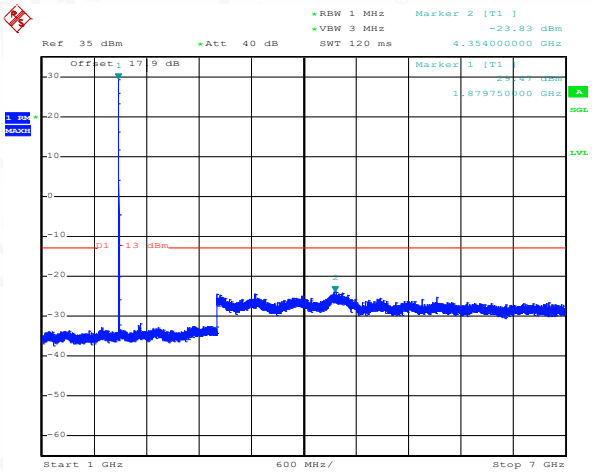


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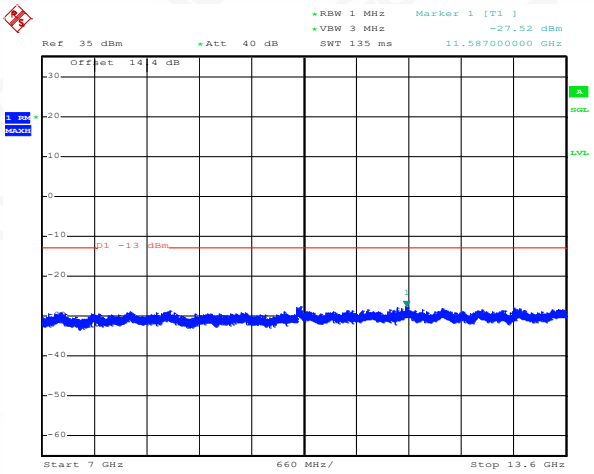


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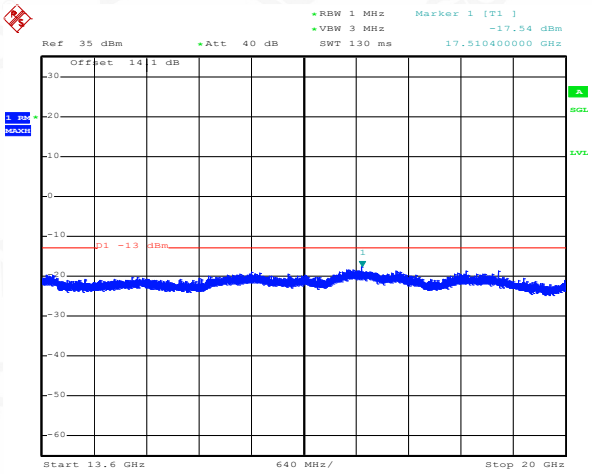


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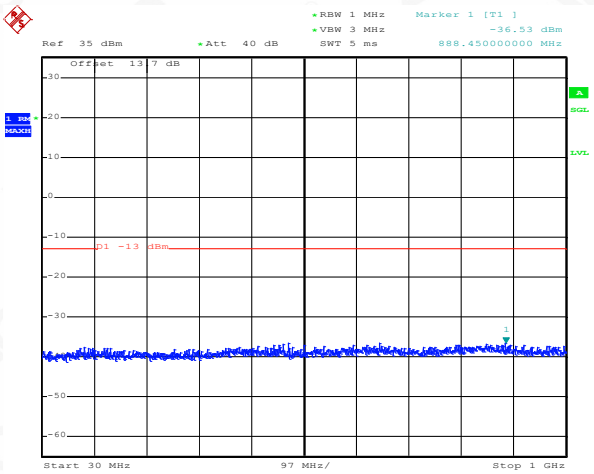


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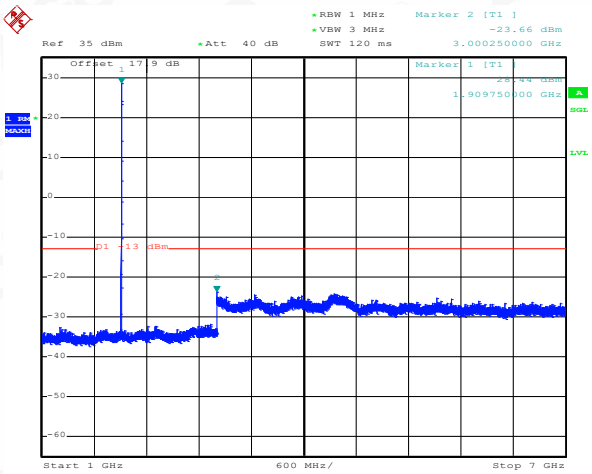


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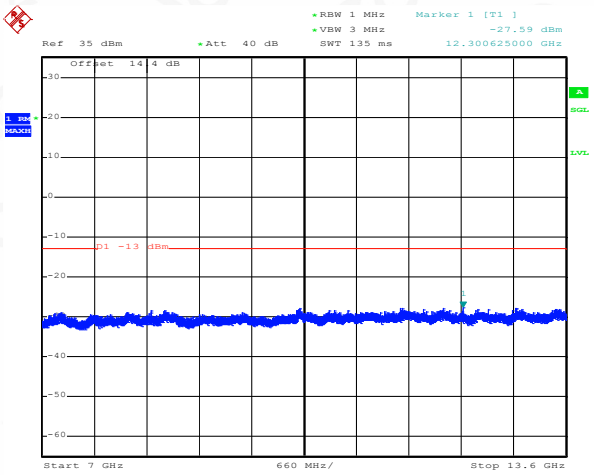


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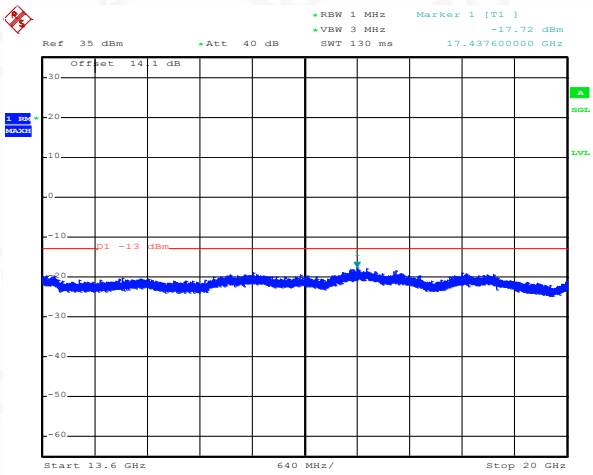


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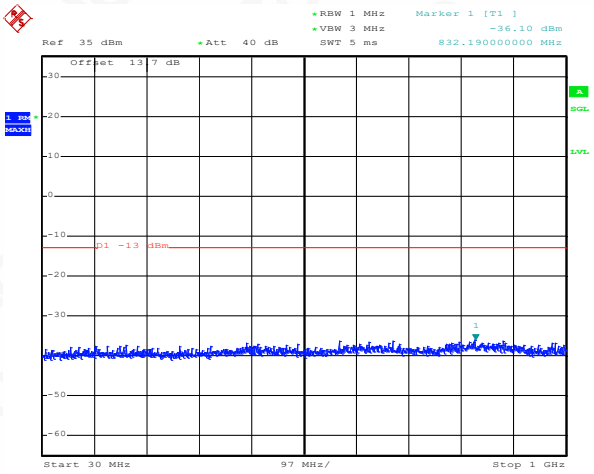
## PCS 1900-LCH-EDGE

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Date: 9.JAN.2020 14:03:10

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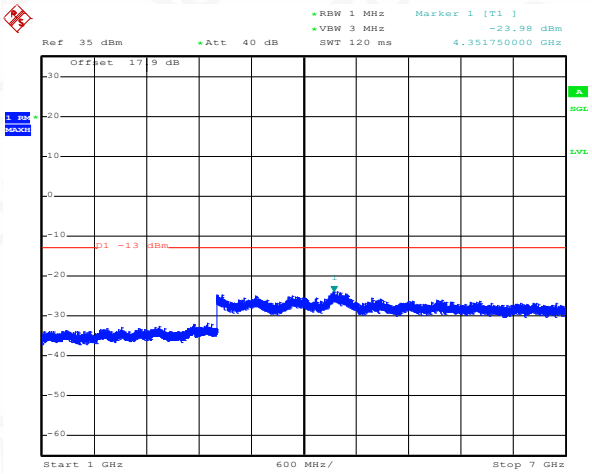


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Date: 9.JAN.2020 14:03:19

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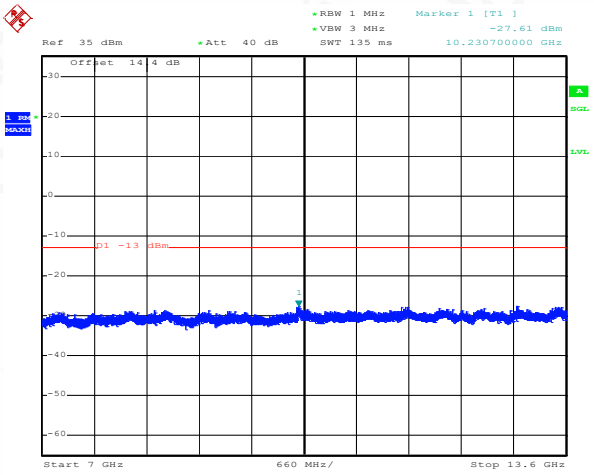


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Date: 9.JAN.2020 14:03:30

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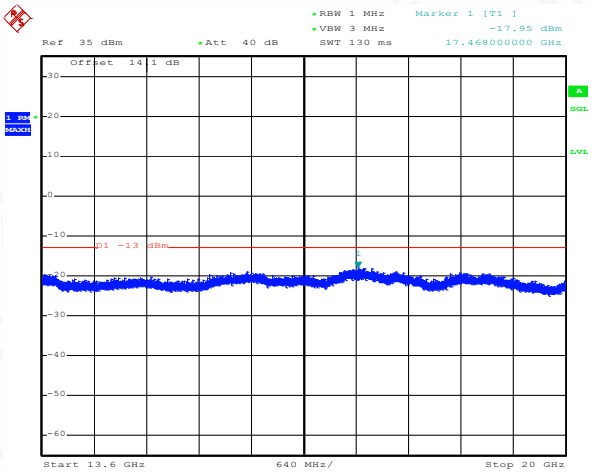


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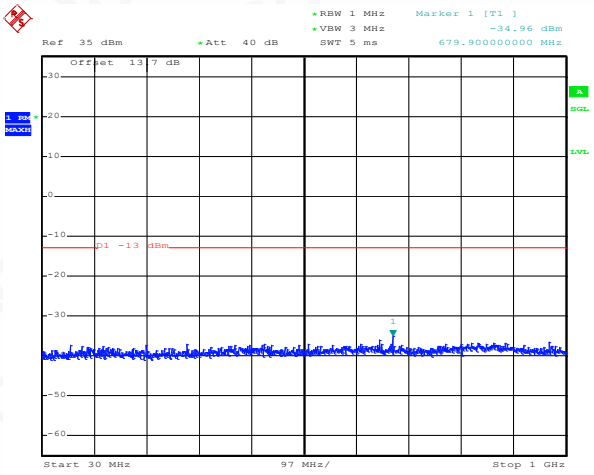
## PCS 1900-MCH-EDGE

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Date: 9.JAN.2020 14:04:33

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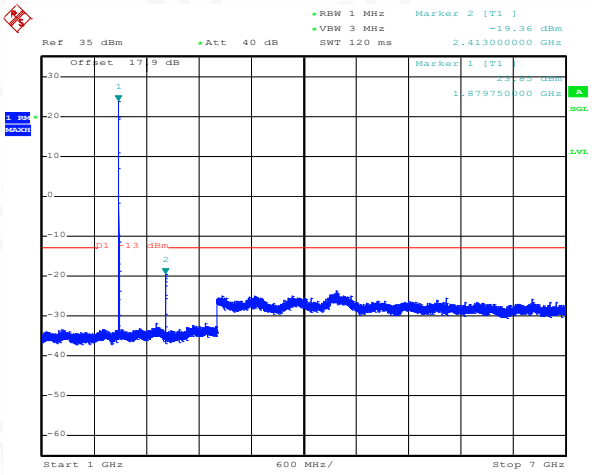


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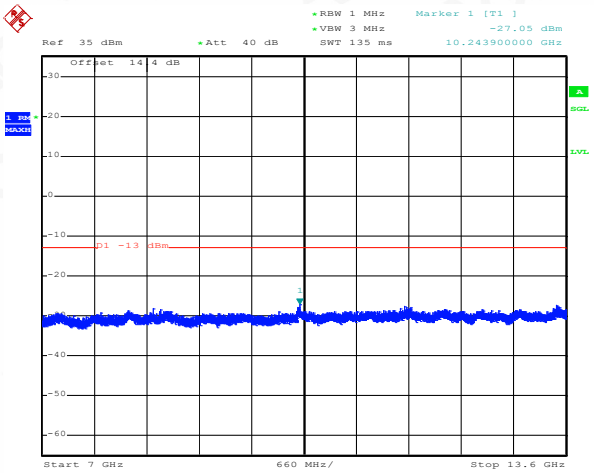


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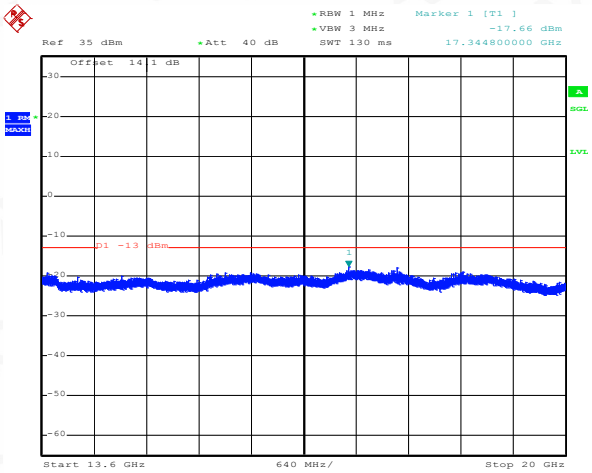
Date: 9.JAN.2020 14:04:54

## PCS 1900- MCH-EDGE

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Date: 9.JAN.2020 14:05:04

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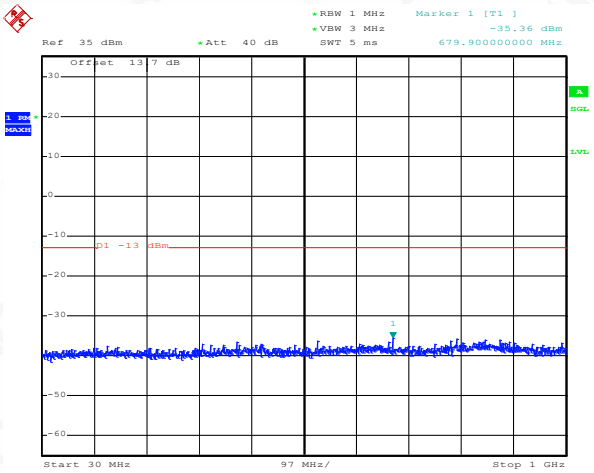


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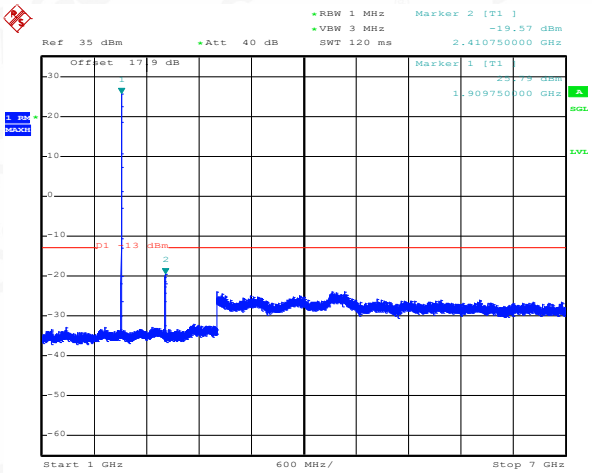


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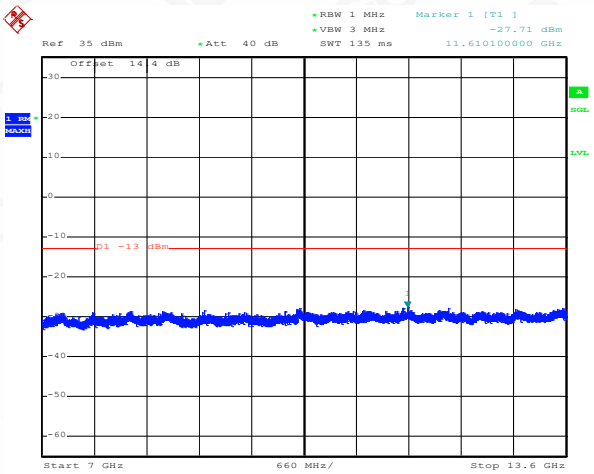
Date: 9.JAN.2020 14:06:06

## PCS 1900- HCH-EDGE

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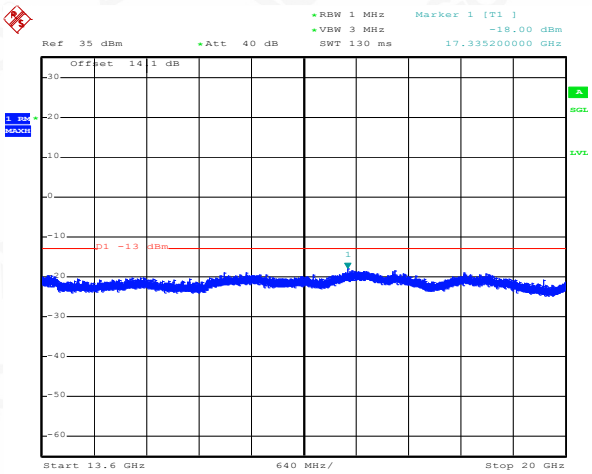
Date: 9.JAN.2020 14:06:16

## PCS 1900- HCH-EDGE

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Date: 9.JAN.2020 14:06:27

**Test Band=WCDMA850/WCDMA1900**

**Test Mode=UMTS**

| WCDMA 850-LCH | WCDMA 850-LCH |
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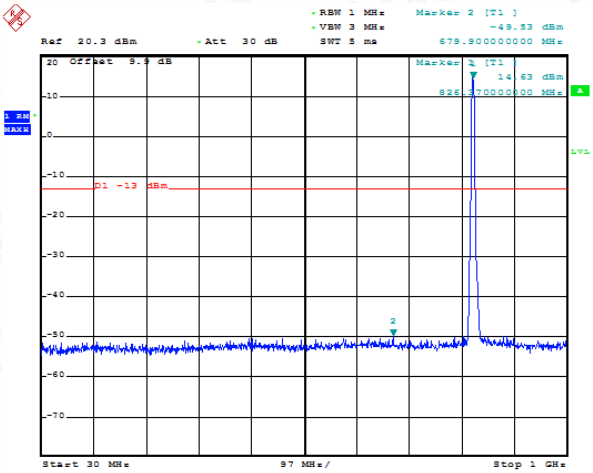
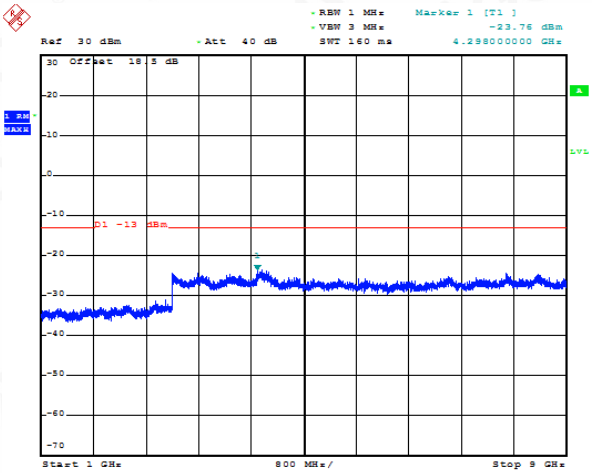
|  |  |
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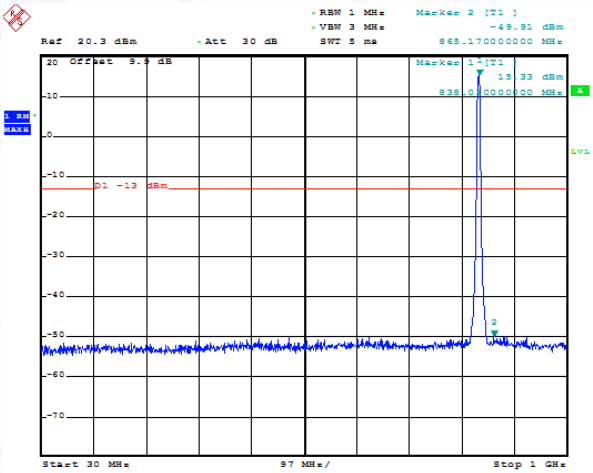
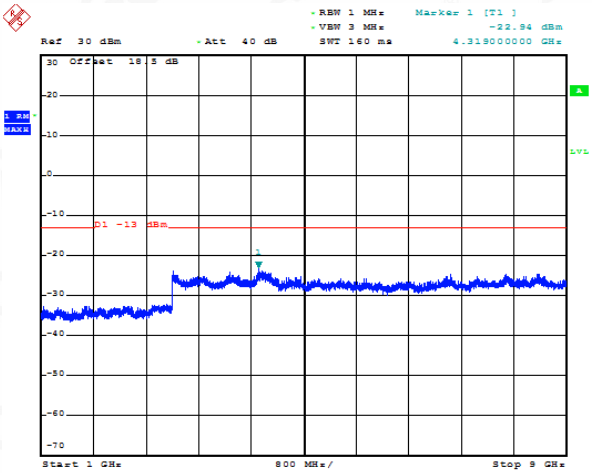
|  |  |
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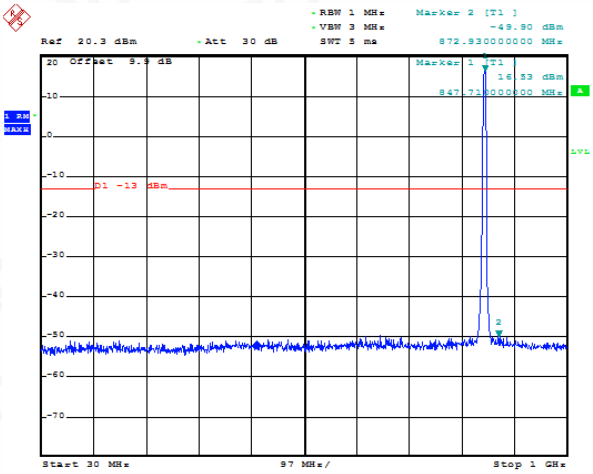
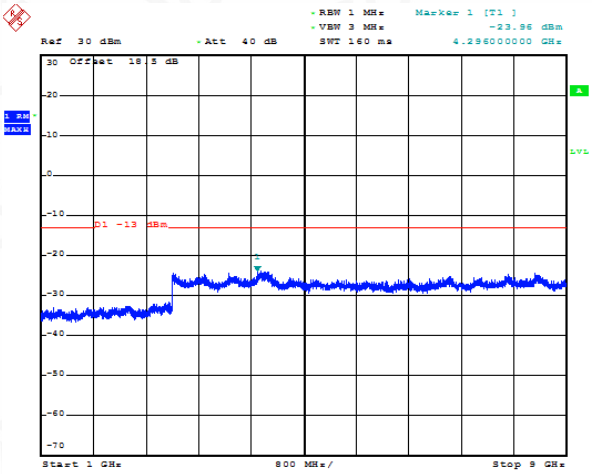
| WCDMA 850-HCH | WCDMA 850-HCH |
|---|---|
|  |  |
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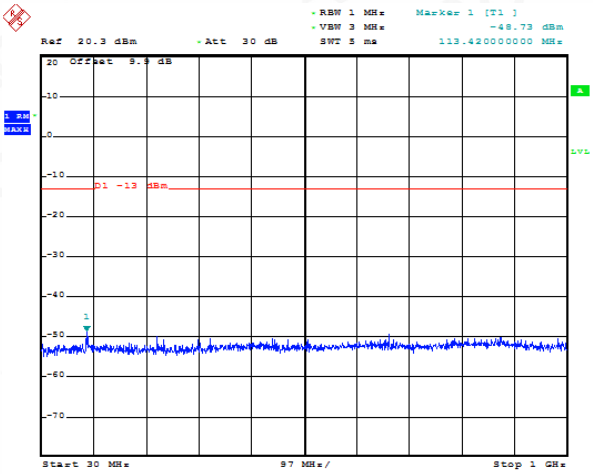
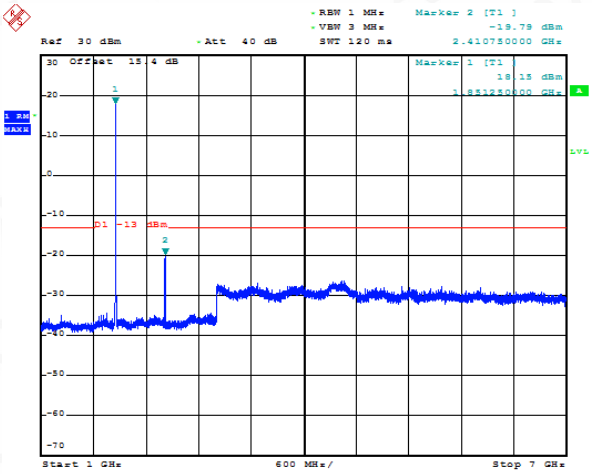
| **WCDMA 1900-LCH** | **WCDMA 1900-LCH** |
|  |  |
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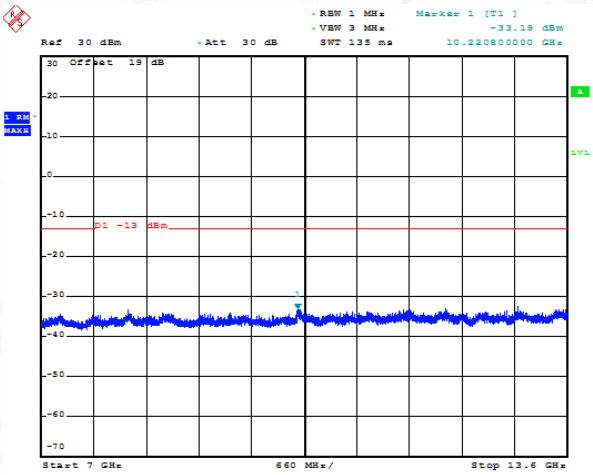
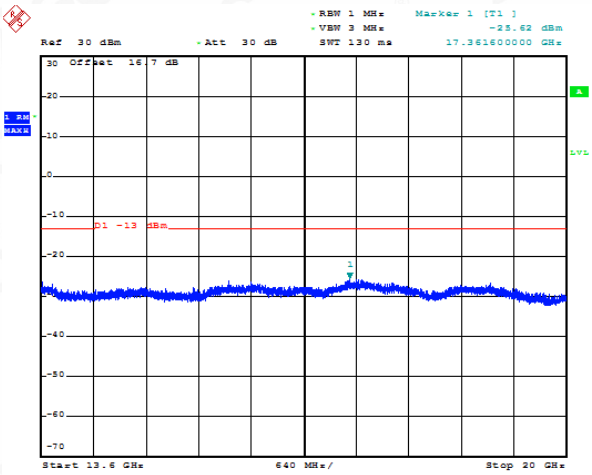
| WCDMA 1900-LCH | WCDMA 1900-LCH |
|---|---|
|  |  |
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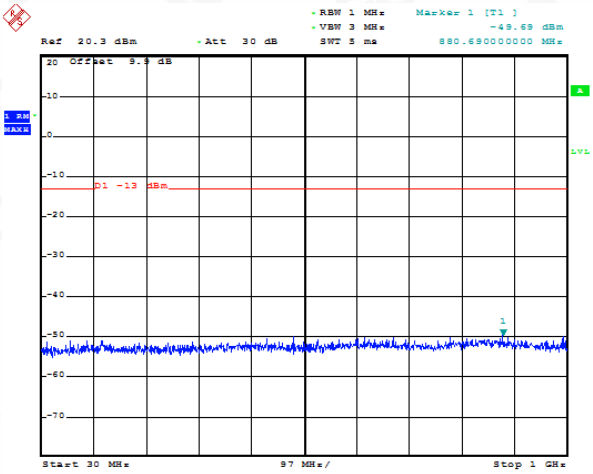
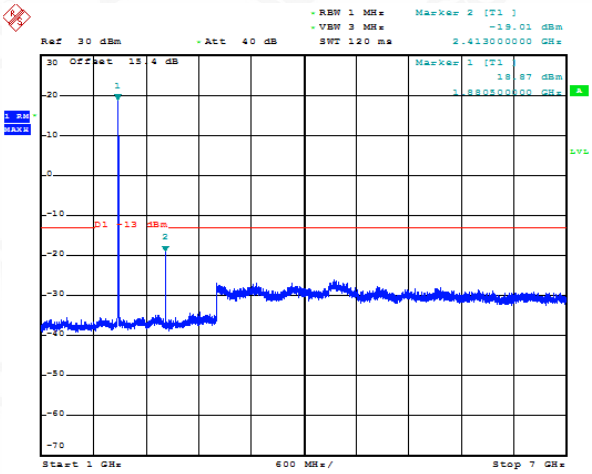
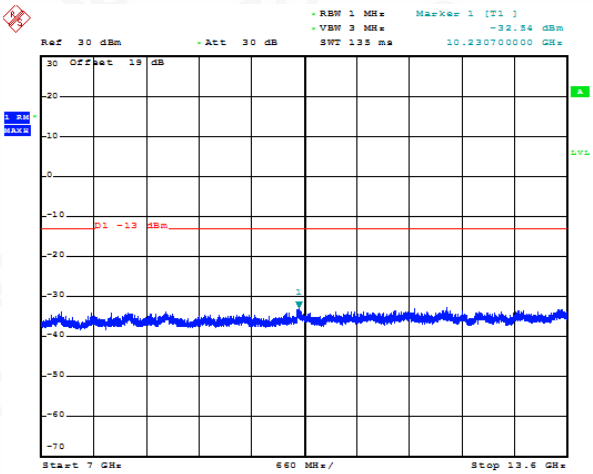
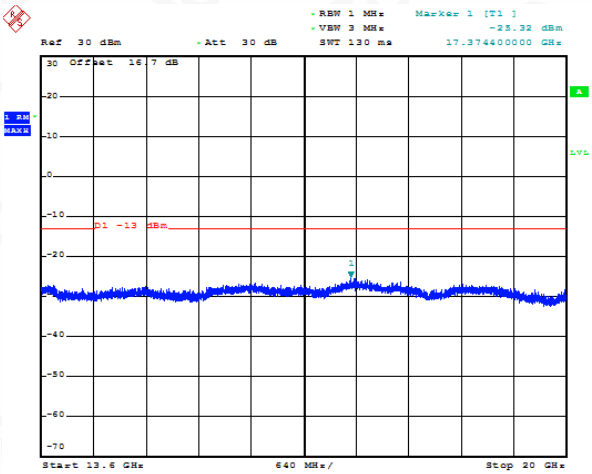
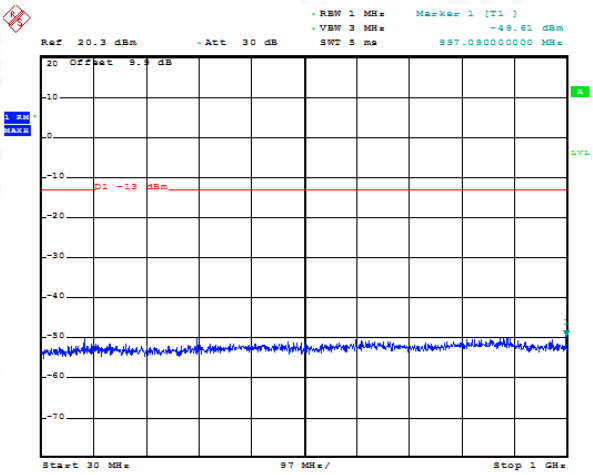
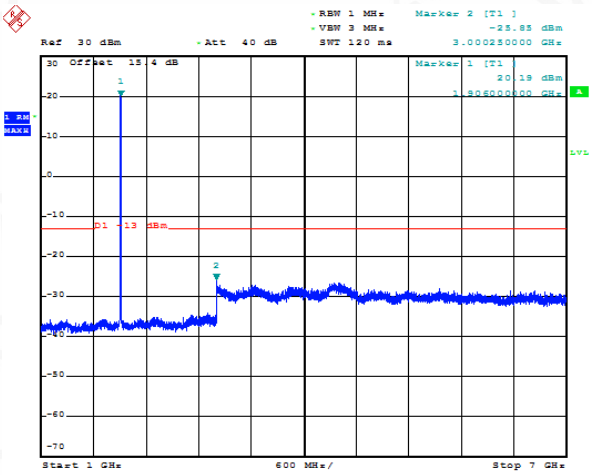
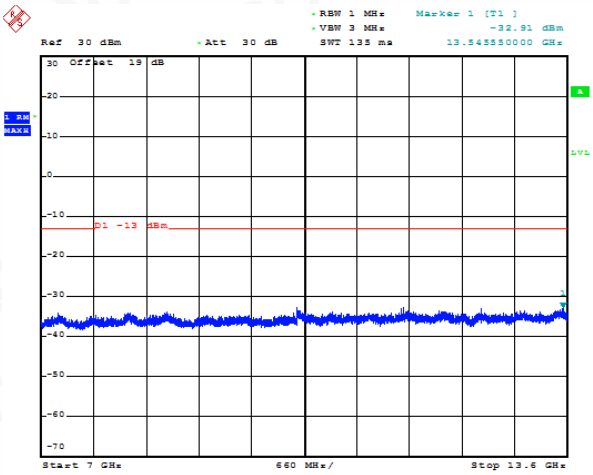
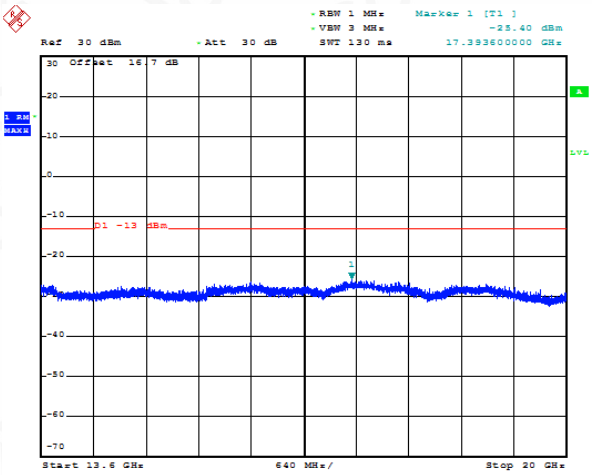
| **WCDMA 1900-MCH** | **WCDMA 1900-MCH** |
|  |  |
| AAA<br>Date: 9.JAN.2020 09:25:35 | AAA<br>Date: 9.JAN.2020 09:25:45 |

| WCDMA 1900-MCH | WCDMA 1900-MCH |
|---|---|
|  |  |
| AAA<br>Date: 9.JAN.2020 09:25:55 | AAA<br>Date: 9.JAN.2020 09:26:04 |
| **WCDMA 1900-HCH** | **WCDMA 1900-HCH** |
|  |  |
| AAA<br>Date: 9.JAN.2020 09:26:34 | AAA<br>Date: 9.JAN.2020 09:26:44 |

| WCDMA 1900-HCH | WCDMA 1900-HCH |
|---|---|
|   AAA<br>Date: 9.JAN.2020 09:26:54 |   AAA<br>Date: 9.JAN.2020 09:27:03 |

**Note:**1. Below 30MHZ no Spurious found and Above is the worst mode data.

2. As no emission found in standby or receive mode, no recording in this report.

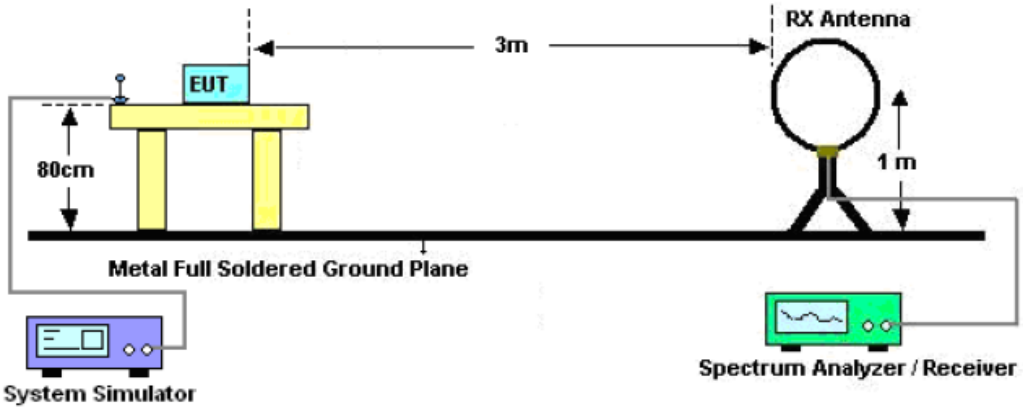
## 9.2 RADIATED SPURIOUS EMISSION

### 9.2.1MEASUREMENT METHOD

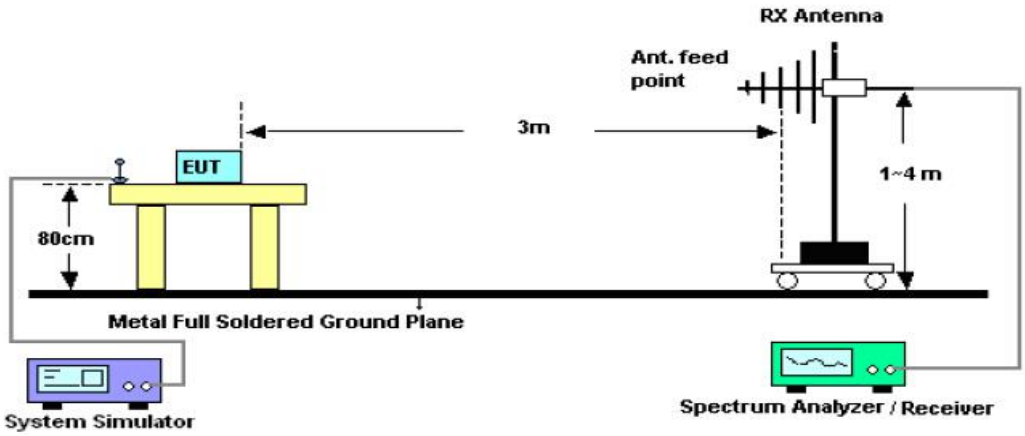
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

### 9.2.2 TEST SETUP

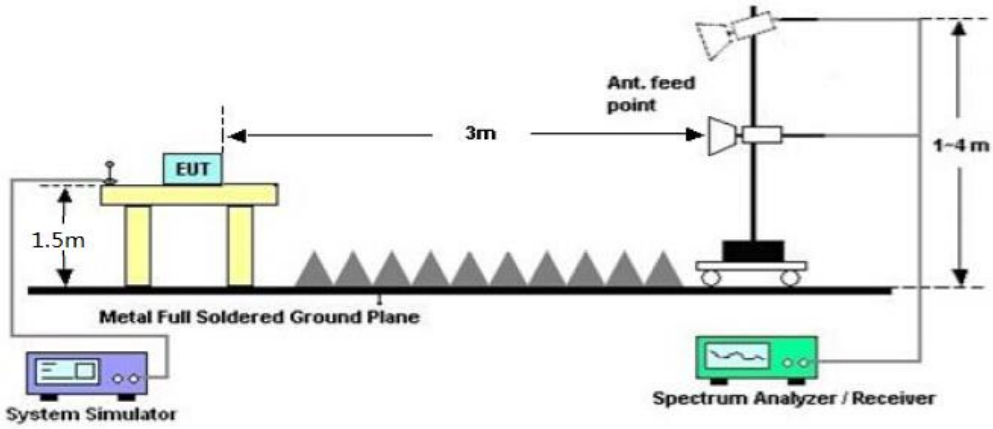
Radiated Emission Test-Setup Frequency Below 30MHz




RADIATED EMISSION TEST SETUP 30MHz-1000MHz




RADIATED EMISSION TEST SETUP ABOVE 1000MHz



### 9.2.3 PROVISIONS APPLICABLE

(a) On any frequency outside a licensee's frequency block (e.g. A, D, B, etc.) within the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

**Note:**only result the worst condition of each test mode:

### 9.2.4 MEASUREMENT RESULT

**GSM 850:**

| The Worst Test Results for Channel 251/848.8 MHz | | | | |
|---|---|---|---|---|
| Frequency (MHz) | Emission Level (dBm) | Limits (dBm) | Margin (dB) | Comment |
| 1967.60 | -52.21 | -13 | -39.21 | Horizontal |
| 3451.58 | -52.69 | -13 | -39.69 | Horizontal |
| 6941.55 | -48.77 | -13 | -35.77 | Horizontal |
| 1967.60 | -53.42 | -13 | -40.42 | Vertical |
| 3274.12 | -49.56 | -13 | -36.56 | Vertical |
| 6369.47 | -49.35 | -13 | -36.35 | Vertical |

**GSM 850(EDGE ):**

| The Worst Test Results for Channel 810/1909.8MHz | | | | |
|---|---|---|---|---|
| Frequency (MHz) | Emission Level (dBm) | Limits (dBm) | Margin (dB) | Comment |
| 1967.60 | -51.24 | -13 | -38.24 | Horizontal |
| 3253.66 | -39.53 | -13 | -26.53 | Horizontal |
| 6642.28 | -50.66 | -13 | -37.66 | Horizontal |
| 1967.60 | -38.58 | -13 | -25.58 | Vertical |
| 3464.55 | -48.09 | -13 | -35.09 | Vertical |
| 6850.47 | -34.54 | -13 | -21.54 | Vertical |

**PCS 1900:**

| The Worst Test Results for Channel 810/1909.8MHz | | | | |
|---|---|---|---|---|
| Frequency (MHz) | Emission Level (dBm) | Limits (dBm) | Margin (dB) | Comment |
| 1748.64 | -54.74 | -13 | -41.74 | Horizontal |
| 3819.60 | -53.34 | -13 | -40.34 | Horizontal |
| 6612.82 | -50.96 | -13 | -37.96 | Horizontal |
| 1807.13 | -52.34 | -13 | -39.34 | Vertical |
| 3819.60 | -52.55 | -13 | -39.55 | Vertical |
| 6633.25 | -49.94 | -13 | -36.94 | Vertical |

**PCS 1900(EDGE ):**

| The Worst Test Results for Channel 810/1909.8MHz | | | | |
|---|---|---|---|---|
| Frequency (MHz) | Emission Level (dBm) | Limits (dBm) | Margin (dB) | Comment |
| 1634.26 | -51.66 | -13 | -38.66 | Horizontal |
| 3819.60 | -40.18 | -13 | -27.18 | Horizontal |
| 6842.13 | -50.35 | -13 | -37.35 | Horizontal |
| 1741.25 | -39.44 | -13 | -26.44 | Vertical |
| 3819.60 | -48.32 | -13 | -35.32 | Vertical |
| 6421.43 | -34.3 | -13 | -21.30 | Vertical |

**HSPA band II:**

| The Worst Test Results for Channel 9538/1907.6MHz | | | | |
|---|---|---|---|---|
| Frequency (MHz) | Emission Level (dBm) | Limits (dBm) | Margin (dB) | Comment |
| 1364.25 | -48.91 | -13 | -35.91 | Horizontal |
| 3815.20 | -47.83 | -13 | -34.83 | Horizontal |
| 6014.39 | -47.17 | -13 | -34.17 | Horizontal |
| 1412.64 | -47.95 | -13 | -34.95 | Vertical |
| 3815.20 | -47.19 | -13 | -34.19 | Vertical |
| 7014.36 | -45.86 | -13 | -32.86 | Vertical |

**HSPA band V:**

| The Worst Test Results for Channel 4233/846.6MHz | | | | |
|---|---|---|---|---|
| Frequency (MHz) | Emission Level (dBm) | Limits (dBm) | Margin (dB) | Comment |
| 1693.20 | -51.09 | -13 | -38.09 | Horizontal |
| 3314.58 | -48.73 | -13 | -35.73 | Horizontal |
| 6415.92 | -48.85 | -13 | -35.85 | Horizontal |
| 1693.20 | -50.48 | -13 | -37.48 | Vertical |
| 3478.09 | -48.39 | -13 | -35.39 | Vertical |
| 6123.50 | -47.68 | -13 | -34.68 | Vertical |

**RESULT: PASS**

**Note:**

1. Margin = Emission Level -Limit
2. Below 30MHZ no Spurious found and Above is the worst mode data

# 10. FREQUENCY STABILITY

## 10.1 MEASUREMENT METHOD

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMU200 DIGITAL RADIO COMMUNICATION TESTER.

1 Measure the carrier frequency at room temperature.

2 Subject the EUT to overnight soak at -10℃.

3 With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on channel 661 for PCS 1900 band , channel 190 for GSM 850 band, channel 9400 for UMTS band II and channel 4175 for UMTS band V measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.

4 Repeat the above measurements at 10℃ increments from -10℃ to +40℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.

5 Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.

6 Subject the EUT to overnight soak at +40℃.

7 With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.

8 Repeat the above measurements at 10℃ increments from +40℃ to -10℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.

9 At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

10 The EUT only works at the extreme temperature from -10℃ to +40℃, it can not transmission at extreme temperatures of -30, -20 & +50 deg C.

## 10.2 PROVISIONS APPLICABLE

### 10.2.1 FOR HAND CARRIED BATTERY POWERED EQUIPMENT

According to the ANSI/TIA-603-E-2016, the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.15VDC and 4.2VDC, with a nominal voltage of3.7 VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance of -10 % and +12.5 %. For the purposes of measuring frequency stability these voltage limits are to be used.

### 10.2.2 FOR EQUIPMENT POWERED BY PRIMARY SUPPLY VOLTAGE

According to the ANSI/TIA-603-E-2016,the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies. This requires varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment, the normal environment temperature is 20$^{o}$C.

## 10.3 MEASUREMENT RESULT

Test Results

Frequency Error vs. Voltage:

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt.(V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| GSM850 | GPRS | LCH | TN | VL | -0.06 | -0.000073 | ±2.5 | PASS |
| | | | TN | VN | -1.87 | -0.002269 | ±2.5 | PASS |
| | | | TN | VH | -9.10 | -0.011041 | ±2.5 | PASS |
| | | MCH | TN | VL | -41.26 | -0.049319 | ±2.5 | PASS |
| | | | TN | VN | -43.39 | -0.051865 | ±2.5 | PASS |
| | | | TN | VH | -40.42 | -0.048315 | ±2.5 | PASS |
| | | HCH | TN | VL | -42.04 | -0.049529 | ±2.5 | PASS |
| | | | TN | VN | -40.81 | -0.048080 | ±2.5 | PASS |
| | | | TN | VH | -34.22 | -0.040316 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt.(V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| GSM850 | EGPRS | LCH | TN | VL | -22.63 | -0.027457 | ±2.5 | PASS |
| | | | TN | VN | -26.22 | -0.031813 | ±2.5 | PASS |
| | | | TN | VH | -24.92 | -0.030235 | ±2.5 | PASS |
| | | MCH | TN | VL | 2.52 | 0.003012 | ±2.5 | PASS |
| | | | TN | VN | 2.36 | 0.002821 | ±2.5 | PASS |
| | | | TN | VH | 5.88 | 0.007028 | ±2.5 | PASS |
| | | HCH | TN | VL | -40.94 | -0.048233 | ±2.5 | PASS |
| | | | TN | VN | -40.71 | -0.047962 | ±2.5 | PASS |
| | | | TN | VH | -44.36 | -0.052262 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt. (V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| PCS 1900 | GPRS | LCH | TN | VL | -27.06 | -0.014625 | PASS |
| | | | TN | VN | -21.11 | -0.011410 | PASS |
| | | | TN | VH | -4.58 | -0.002475 | PASS |
| | | MCH | TN | VL | -10.98 | -0.005840 | PASS |
| | | | TN | VN | -7.17 | -0.003814 | PASS |
| | | | TN | VH | -4.20 | -0.002234 | PASS |
| | | HCH | TN | VL | -1.42 | -0.000744 | PASS |
| | | | TN | VN | -1.61 | -0.000843 | PASS |
| | | | TN | VH | -35.32 | -0.018494 | PASS |

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt. (V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| GSM1900 | EGPRS | LCH | TN | VL | 28.83 | 0.015582 | PASS |
| | | | TN | VN | 10.88 | 0.005880 | PASS |
| | | | TN | VH | -15.08 | -0.008150 | PASS |
| | | MCH | TN | VL | -42.13 | -0.022410 | PASS |
| | | | TN | VN | -30.57 | -0.016261 | PASS |
| | | | TN | VH | -38.61 | -0.020537 | PASS |
| | | HCH | TN | VL | -30.67 | -0.016059 | PASS |
| | | | TN | VN | -37.52 | -0.019646 | PASS |
| | | | TN | VH | -36.06 | -0.018882 | PASS |

Note: Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very samll. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted duing the frequency stability tests is applied. Therefore the device is detemined to remain operating in band over the temperture and voltage range as tested.

**Frequency Error vs. Temperature:**

| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| GSM850 | GPRS | LCH | VN | -10 | -44.36 | -0.053822 | ±2.5 | PASS |
| | | | VN | 0 | -38.74 | -0.047003 | ±2.5 | PASS |
| | | | VN | 10 | -41.20 | -0.049988 | ±2.5 | PASS |
| | | | VN | 20 | -43.97 | -0.053349 | ±2.5 | PASS |
| | | | VN | 30 | -42.75 | -0.051868 | ±2.5 | PASS |
| | | | VN | 40 | -39.71 | -0.048180 | ±2.5 | PASS |
| GSM850 | GPRS | MCH | VN | -10 | -39.91 | -0.047705 | ±2.5 | PASS |
| | | | VN | 0 | -43.72 | -0.052259 | ±2.5 | PASS |
| | | | VN | 10 | -41.39 | -0.049474 | ±2.5 | PASS |
| | | | VN | 20 | -41.20 | -0.049247 | ±2.5 | PASS |
| | | | VN | 30 | -40.03 | -0.047848 | ±2.5 | PASS |
| | | | VN | 40 | -40.74 | -0.048697 | ±2.5 | PASS |
| GSM850 | GPRS | HCH | VN | -10 | -42.94 | -0.050589 | ±2.5 | PASS |
| | | | VN | 0 | -45.65 | -0.053782 | ±2.5 | PASS |
| | | | VN | 10 | -42.81 | -0.050436 | ±2.5 | PASS |
| | | | VN | 20 | -38.36 | -0.045193 | ±2.5 | PASS |
| | | | VN | 30 | -42.23 | -0.049753 | ±2.5 | PASS |
| | | | VN | 40 | -37.52 | -0.044204 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| GSM850 | EGPRS | LCH | VN | -10 | -16.69 | -0.020250 | ±2.5 | PASS |
| | | | VN | 0 | -16.85 | -0.020444 | ±2.5 | PASS |
| | | | VN | 10 | -15.43 | -0.018721 | ±2.5 | PASS |
| | | | VN | 20 | -10.88 | -0.013201 | ±2.5 | PASS |
| | | | VN | 30 | -5.10 | -0.006188 | ±2.5 | PASS |
| | | | VN | 40 | 1.00 | 0.001213 | ±2.5 | PASS |
| GSM850 | EGPRS | MCH | VN | -10 | 7.94 | 0.009491 | ±2.5 | PASS |
| | | | VN | 0 | 10.65 | 0.012730 | ±2.5 | PASS |
| | | | VN | 10 | 3.29 | 0.003933 | ±2.5 | PASS |
| | | | VN | 20 | -56.11 | -0.067069 | ±2.5 | PASS |
| | | | VN | 30 | -51.85 | -0.061977 | ±2.5 | PASS |
| | | | VN | 40 | -48.88 | -0.058427 | ±2.5 | PASS |
| GSM850 | EGPRS | HCH | VN | -10 | -34.00 | -0.040057 | ±2.5 | PASS |
| | | | VN | 0 | -33.38 | -0.039326 | ±2.5 | PASS |
| | | | VN | 10 | -24.50 | -0.028864 | ±2.5 | PASS |
| | | | VN | 20 | -18.82 | -0.022172 | ±2.5 | PASS |
| | | | VN | 30 | -15.82 | -0.018638 | ±2.5 | PASS |
| | | | VN | 40 | -10.20 | -0.012017 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| PCS1900 | GPRS | LCH | VN | -10 | -4.26 | -0.002302 | PASS |
| | | | VN | 0 | -4.91 | -0.002654 | PASS |
| | | | VN | 10 | -0.65 | -0.000351 | PASS |
| | | | VN | 20 | 6.01 | 0.003248 | PASS |
| | | | VN | 30 | -2.71 | -0.001465 | PASS |
| | | | VN | 40 | -33.84 | -0.018290 | PASS |
| PCS1900 | GPRS | MCH | VN | -10 | -7.49 | -0.003984 | PASS |
| | | | VN | 0 | -15.88 | -0.008447 | PASS |
| | | | VN | 10 | -14.98 | -0.007968 | PASS |
| | | | VN | 20 | -12.27 | -0.006527 | PASS |
| | | | VN | 30 | -9.43 | -0.005016 | PASS |
| | | | VN | 40 | -27.64 | -0.014702 | PASS |
| PCS1900 | GPRS | HCH | VN | -10 | -3.23 | -0.001691 | PASS |
| | | | VN | 0 | -19.50 | -0.010210 | PASS |
| | | | VN | 10 | -14.79 | -0.007744 | PASS |
| | | | VN | 20 | -12.27 | -0.006425 | PASS |
| | | | VN | 30 | -18.14 | -0.009498 | PASS |
| | | | VN | 40 | -7.17 | -0.003754 | PASS |

| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| PCS1900 | EGPRS | LCH | VN | -10 | -13.40 | -0.007242 | PASS |
| | | | VN | 0 | -42.65 | -0.023052 | PASS |
| | | | VN | 10 | -58.24 | -0.031478 | PASS |
| | | | VN | 20 | -60.37 | -0.032629 | PASS |
| | | | VN | 30 | -27.99 | -0.015128 | PASS |
| | | | VN | 40 | -47.65 | -0.025754 | PASS |
| PCS1900 | EGPRS | MCH | VN | -10 | -2.58 | -0.001372 | PASS |
| | | | VN | 0 | -2.87 | -0.001527 | PASS |
| | | | VN | 10 | -10.20 | -0.005426 | PASS |
| | | | VN | 20 | -19.40 | -0.010319 | PASS |
| | | | VN | 30 | -23.63 | -0.012569 | PASS |
| | | | VN | 40 | -19.73 | -0.010495 | PASS |
| PCS1900 | EGPRS | HCH | VN | -10 | -13.46 | -0.007048 | PASS |
| | | | VN | 0 | -14.24 | -0.007456 | PASS |
| | | | VN | 10 | -16.79 | -0.008791 | PASS |
| | | | VN | 20 | -23.60 | -0.012357 | PASS |
| | | | VN | 30 | -18.34 | -0.009603 | PASS |
| | | | VN | 40 | -30.93 | -0.016195 | PASS |

Note: Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very samll. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted duing the frequency stability tests is applied. Therefore the device is detemined to remain operating in band over the temperture and voltage range as tested.

**Frequency Error vs. Voltage:**

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt.(V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| WCDMA850 | UMTS | LCH | TN | VL | 4.81 | 0.01 | ±2.5 | PASS |
| | | | TN | VN | 5.81 | 0.01 | ±2.5 | PASS |
| | | | TN | VH | 5.92 | 0.01 | ±2.5 | PASS |
| | | MCH | TN | VL | 4.17 | 0.00 | ±2.5 | PASS |
| | | | TN | VN | -0.31 | 0.00 | ±2.5 | PASS |
| | | | TN | VH | 4.35 | 0.01 | ±2.5 | PASS |
| | | HCH | TN | VL | 4.25 | 0.00 | ±2.5 | PASS |
| | | | TN | VN | -0.36 | 0.02 | ±2.5 | PASS |
| | | | TN | VH | 4.38 | 0.03 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt.(V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| WCDMA1900 | UMTS | LCH | TN | VL | -9.95 | -0.01 | PASS |
| | | | TN | VN | 1.10 | 0.00 | PASS |
| | | | TN | VH | 3.07 | 0.00 | PASS |
| | | MCH | TN | VL | 7.74 | 0.00 | PASS |
| | | | TN | VN | 10.57 | 0.01 | PASS |
| | | | TN | VH | 5.17 | 0.00 | PASS |
| | | HCH | TN | VL | 427.83 | 0.22 | PASS |
| | | | TN | VN | 3171.94 | 1.66 | PASS |
| | | | TN | VH | 3342.96 | 1.75 | PASS |

Note: Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is detemined to remain operating in band over the temperature and voltage range as tested.

**Frequency Error vs. Temperature:**

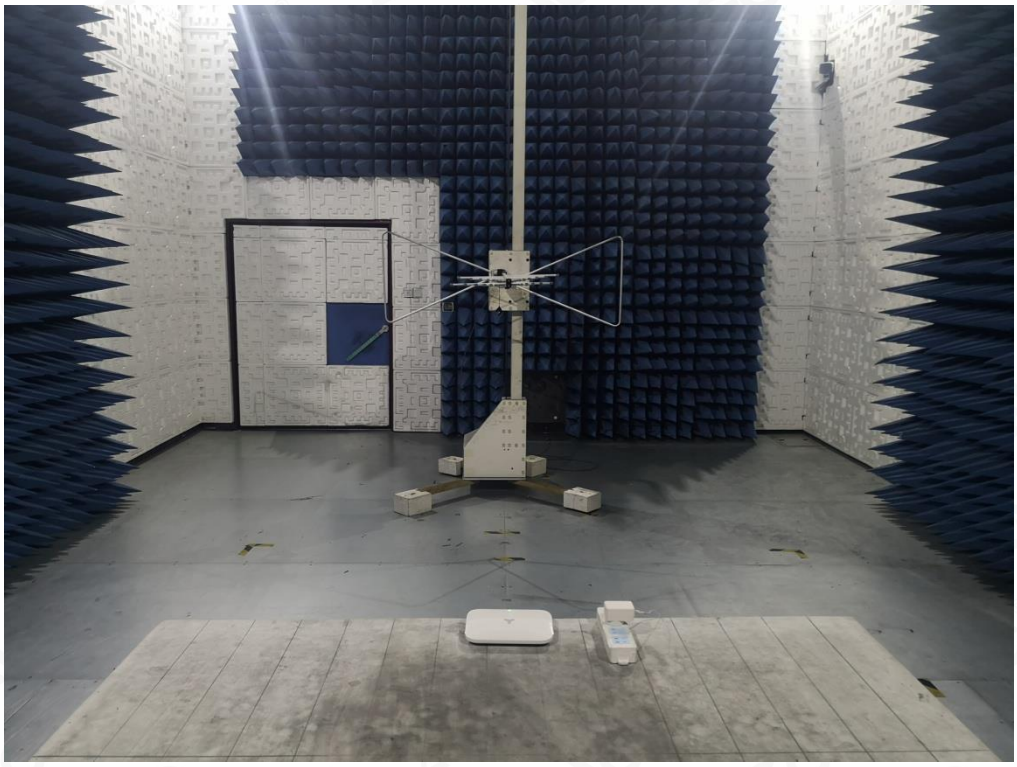
| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| WCDMA850 | UMTS | LCH | VN | -10 | 2.26 | 0.00 | ±2.5 | PASS |
| | | | VN | 0 | 2.38 | 0.00 | ±2.5 | PASS |
| | | | VN | 10 | -2.81 | 0.00 | ±2.5 | PASS |
| | | | VN | 20 | 0.87 | 0.00 | ±2.5 | PASS |
| | | | VN | 30 | 4.75 | 0.01 | ±2.5 | PASS |
| | | | VN | 40 | 0.78 | 0.00 | ±2.5 | PASS |
| WCDMA850 | UMTS | MCH | VN | -10 | 0.55 | 0.00 | ±2.5 | PASS |
| | | | VN | 0 | 2.52 | 0.00 | ±2.5 | PASS |
| | | | VN | 10 | 3.71 | 0.00 | ±2.5 | PASS |
| | | | VN | 20 | 7.00 | 0.01 | ±2.5 | PASS |
| | | | VN | 30 | 4.81 | 0.01 | ±2.5 | PASS |
| | | | VN | 40 | -0.43 | 0.00 | ±2.5 | PASS |
| WCDMA850 | UMTS | HCH | VN | -10 | 0.53 | 0.00 | ±2.5 | PASS |
| | | | VN | 0 | 2.52 | 0.03 | ±2.5 | PASS |
| | | | VN | 10 | 3.25 | 0.04 | ±2.5 | PASS |
| | | | VN | 20 | 6.32 | 0.06 | ±2.5 | PASS |
| | | | VN | 30 | 4.52 | 0.01 | ±2.5 | PASS |
| | | | VN | 40 | -0.43 | 0.05 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| WCDMA1900 | UMTS | LCH | VN | -10 | 1.56 | 0.00 | PASS |
| | | | VN | 0 | 5.22 | 0.00 | PASS |
| | | | VN | 10 | 2.29 | 0.00 | PASS |
| | | | VN | 20 | -3.63 | 0.00 | PASS |
| | | | VN | 30 | -7.84 | 0.00 | PASS |
| | | | VN | 40 | -8.39 | 0.00 | PASS |
| WCDMA1900 | UMTS | MCH | VN | -10 | 13.34 | 0.01 | PASS |
| | | | VN | 0 | 5.83 | 0.00 | PASS |
| | | | VN | 10 | -2.61 | 0.00 | PASS |
| | | | VN | 20 | -5.22 | 0.00 | PASS |
| | | | VN | 30 | 3.60 | 0.00 | PASS |
| | | | VN | 40 | -4.09 | 0.00 | PASS |
| WCDMA1900 | UMTS | HCH | VN | -10 | 12.30 | 0.06 | PASS |
| | | | VN | 0 | 5.25 | 0.00 | PASS |
| | | | VN | 10 | -2.36 | 0.00 | PASS |
| | | | VN | 20 | -5.21 | 0.00 | PASS |
| | | | VN | 30 | 3.58 | 0.00 | PASS |
| | | | VN | 40 | -4.13 | 0.00 | PASS |

Note: Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very samll. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted duing the frequency stability tests is applied. Therefore the device is detemined to remain operating in band over the temperture and voltage range as tested.

# APPENDIX A: PHOTOGRAPHS OF TEST SETUP

RADIATED SPURIOUS EMISSION



RADIATED SPURIOUS ABOVE 1G EMISSION

# APPENDIX B: PHOTOGRAPHS OF EUT

Refer to Attached file(Appendix I)

**----END OF REPORT----**