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# Report On

FCC Testing of the
Sharp CDMA SHI15 Dual Band CDMA (BC0 and BC6) and Tri Band GSM (900, 1800 and 1900 MHz) Dual Mode Cellular Phone with Bluetooth, FeliCa, WLAN and GPS
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24

COMMERCIAL-IN-CONFIDENCE

FCC ID: APYHRO00171

Document 75917027 Report 10 Issue 2 June 2012

Product Service

TÜV SÜD Product Service Ltd, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuvps.co.uk



**REPORT ON**

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In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24

Document 75917027 Report 10 Issue 2

June 2012

**PREPARED FOR**

Sharp Communication Compliance Ltd
Azure House
Bagshot Road
Bracknell
Berkshire
RG12 7QY

**PREPARED BY**

**Natalie Bennett**
Senior Administrator (Technical)

**APPROVED BY**

**Mark Jenkins**
Authorised Signatory

**DATED** 22 June 2012

**This report has been up-issued to Issue 2 to amend formatting errors.**

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s):

S Bennett G Lawler

UKAS TESTING 0141

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**SECTION 1**

**REPORT SUMMARY**

FCC Testing of the
Sharp CDMA SHI15 Dual Band CDMA (BC0 and BC6) and Tri Band GSM (900, 1800 and 1900 MHz) Dual Mode Cellular Phone with Bluetooth, FeliCa, WLAN and GPS
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24

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## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the FCC Testing of the Sharp CDMA SHI15 Dual Band CDMA (BC0 and BC6) and Tri Band GSM (900, 1800 and 1900 MHz) Dual Mode Cellular Phone with Bluetooth, FeliCa, WLAN and GPS to the requirements of FCC CFR 47 Part 2 and FCC CFR 47 Part 24.

| | |
|---|---|
| Objective | To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out. |
| Manufacturer | Sharp Corporation |
| Model Number(s) | CDMA SHI15 |
| Serial Number(s) | IMEI 004401113999888<br>IMEI 004401114000199<br>IMEI 004401114000066 |
| Number of Samples Tested | 3 |
| Test Specification/Issue/Date | FCC CFR 47 Part 2 (2011)<br>FCC CFR 47 Part 24 (2011) |
| Incoming Release<br>Date | Application Form<br>02 May 2012 |
| Disposal<br>Reference Number<br>Date | Held Pending Disposal<br>Not Applicable<br>Not Applicable |
| Order Number<br>Date | 9100<br>02 April 2012 |
| Start of Test | 14 May 2012 |
| Finish of Test | 18 June 2012 |
| Name of Engineer(s) | S Bennett<br>G Lawler |
| Related Document(s) | ANSI C63.4: 2003 |

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## 1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24 is shown below.

| Section | Spec Clause | | Test Description | Result | Comments/Base Standard |
|---|---|---|---|---|---|
| | Pt2 | Pt24 | | | |
| PCS 1900 - GMSK | | | | | |
| 2.1 | 2.1055 | 24.135(a) | Frequency Stability | Pass | |
| 2.2 | 2.1051 | 24.229 | Spurious Emissions at Band Edge | Pass | |
| 2.3 | - | 24.232(c) | Effective Isotropic Radiated Power | Pass | |
| 2.4 | 2.1046 | 24.232 | Maximum Peak Output Power - Conducted | Pass | |
| 2.5 | 2.1047(d) | - | Modulation Characteristics | - | Customer Declaration |
| 2.6 | 2.1051 | 24.238 | Emission for Broadband PCS Equipment | Pass | |
| 2.7 | 2.1051 | 24.238(a) | Conducted Spurious Emissions | Pass | |
| 2.8 | 2.1049(h) | 24.238(b) | Occupied Bandwidth | Pass | |

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## 1.3 APPLICATION FORM

**APPLICANT'S DETAILS**

COMPANY NAME : Sharp Telecommunications of Europe Ltd
ADDRESS : Azure House, Bagshot Road
Bracknell, Berkshire
RG12 7QY

NAME FOR CONTACT PURPOSES : Ken Newman

TELEPHONE NO: 01344 301 883 FAX NO: 01344 300 293
E-MAIL: ken.newman@sharp.eu

**EQUIPMENT INFORMATION**

Equipment designator:
Model name/number CDMA SHI15 Identification number APYHRO00171

Supply Voltage:
[ ] AC mains State AC voltage …… V and AC frequency …… Hz
[ ] DC (external) State DC voltage …… V and DC current …… A
[ X ] DC (internal) State DC voltage …3.7 V and Battery type…Li-Ion.

Frequency characteristics:
Frequency range 1850.2MHz to 1909.8 MHz MHz Channel spacing …….
(if channelized)

Designated test frequencies:
Bottom: 1850.2 MHz Middle: 1880.0 MHzMHz Top: 1909.8 MHzMHz

Power characteristics:
Maximum transmitter power 1.58W(32dBm) Minimum transmitter power …… W
(if variable)

[ X ] Continuous transmission
[ ] Intermittent transmission State duty cycle ……
If intermittent, can transmitter be set to continuous transmit test mode? Y/N

Antenna characteristics:
[ X ] Antenna connector State impedance 50 ohm
[ ] Temporary antenna connector State impedance …… ohm
[ ] Integral antenna State gain …… dBi

Modulation characteristics:
[ ] Amplitude [ ] Other
[ ] Frequency Details: ……..
[ X ] Phase
Can the transmitter operate un-modulated? ~~Y~~/N
ITU Class of emission: ……

Extreme conditions:
Maximum temperature 60 ºC Minimum temperature -20 ºC
Maximum supply voltage 4.0 V Minimum supply voltage 3.7 V

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature : Satomi Amaki
Name : Satomi Amaki
Position held : Manager
Date : 02 May 2012

## 1.4 PRODUCT INFORMATION

### 1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp CDMA SHI15 Dual Band CDMA (BC0 and BC6) and Tri Band GSM (900, 1800 and 1900 MHz) Dual Mode Cellular Phone with Bluetooth, FeliCa, WLAN and GPS. A full technical description can be found in the manufacturer's documentation.

## 1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 4.0 V DC supply.

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

## 1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard or test plan were made during testing.

## 1.7 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.

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# SECTION 2

# TEST DETAILS

FCC Testing of the
Sharp CDMA SHI15 Dual Band CDMA (BC0 and BC6) and Tri Band GSM (900, 1800 and 1900 MHz) Dual Mode Cellular Phone with Bluetooth, FeliCa, WLAN and GPS
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24

## 2.1 FREQUENCY STABILITY

### 2.1.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055
FCC CFR 47 Part 24, Clause 24.135(a)

### 2.1.2 Equipment Under Test and Modification State

CDMA SHI15 S/N: IMEI 004401113999888 - Modification State 0

### 2.1.3 Date of Test

18 June 2012

### 2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.1.5 Test Procedure

The EUT was set to transmit on maximum power with GMSK modulation. A Radio Communications Analyser, was used to measure the frequency error. The maximum result was taken over 200 bursts. The temperature was adjusted between -30°C and +50°C in 10° steps as per 2.1055.

### 2.1.6 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 21.7°C |
| Relative Humidity | 35.2% |

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### 2.1.7 Test Results

4.0 V DC Supply

Under Temperature Variations

1880.0 MHz

| Temperature Interval (ºC) | Mode | Deviation (ppm) |
|---|---|---|
| -30 | GMSK | 0.0164 |
| -20 | GMSK | 0.0162 |
| -10 | GMSK | 0.0159 |
| 0 | GMSK | 0.0160 |
| +10 | GMSK | 0.0157 |
| +20 | GMSK | 0.0157 |
| +30 | GMSK | 0.0155 |
| +40 | GMSK | 0.0154 |
| +50 | GMSK | 0.0155 |

Limit Clause

The frequency stability of the transmitter shall be maintained within ± 0.0001 % (± 1 ppm).

Under Voltage Variations

1880.0 MHz

| DC Voltage (V) | Mode | Deviation (ppm) |
|---|---|---|
| 4.0 | GMSK | 0.0157 |
| 3.7 | GMSK | 0.0157 |

Limit Clause

The frequency stability of the transmitter shall be maintained within ± 0.0001 % (± 1 ppm).

## 2.2 SPURIOUS EMISSIONS AT BAND EDGE

### 2.2.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 24, Clause 24.229

### 2.2.2 Equipment Under Test and Modification State

CDMA SHI15 S/N: IMEI 004401113999888 - Modification State 0

### 2.2.3 Date of Test

12 June 2012

### 2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.2.5 Test Procedure

In accordance with 24.238, any emissions outside of the block edges shall be attenuated by at least 43 + 10 log (P). The measurements are shown to ±1 MHz from the block edges. The plots shown under the Spurious Emissions sections covers the required range of 9 kHz to 20 GHz.

The reference power and path losses of all channels used for testing in each frequency block were measured. Having entered the reference level offset , a limit line was displayed, showing the -13 dBm (43 + 10 log (P)), limit.

### 2.2.6 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23.4°C |
| Relative Humidity | 35.6% |

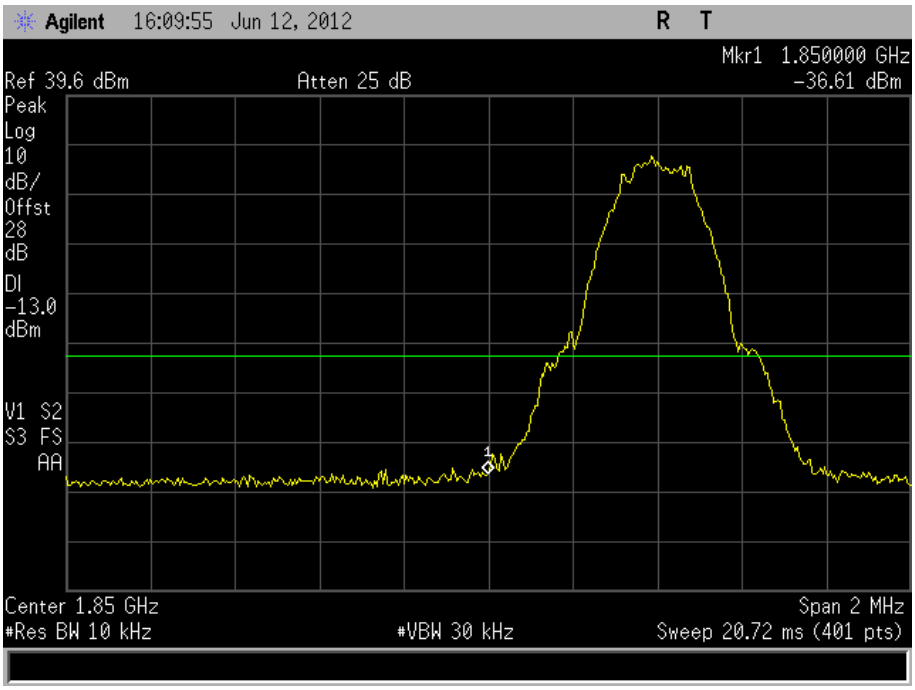
Product Service

### 2.2.7 Test Results

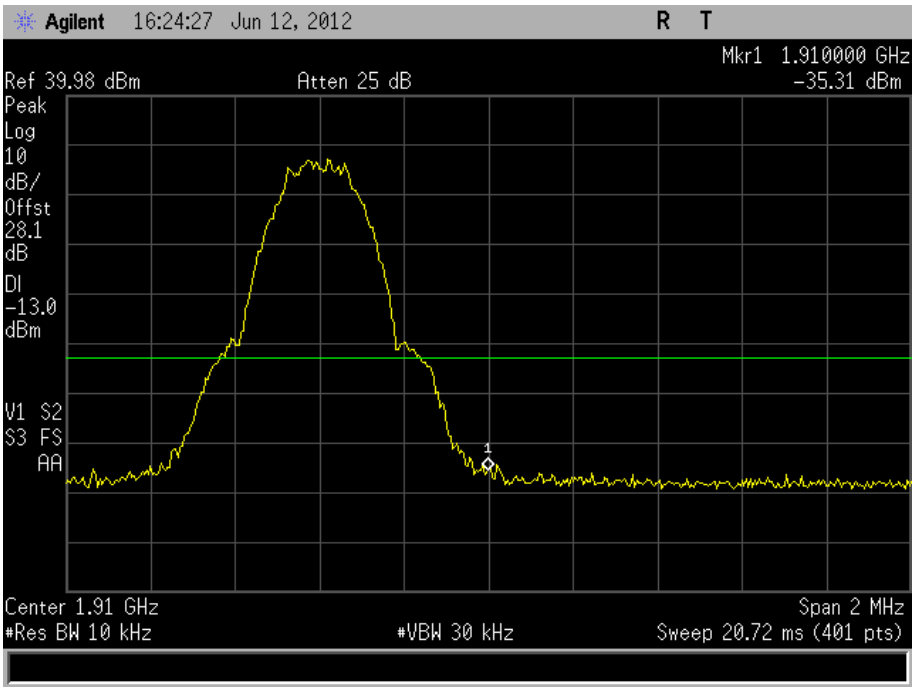
4.0 V DC Supply

| Frequency Block (MHz) | Mode | Lower Block Edge Test Channels/Frequencies | Upper Block Edge Test Channels/Frequencies |
|---|---|---|---|
| A :(1930.0 – 1945.0) | GMSK | Channel : 513<br>Frequency : 1850.4 MHz | N/A |
| B :(1975.0 – 1990.0) | GMSK | N/A | Channel : 809<br>Frequency : 1909.6 MHz |

Frequency Block A



Frequency Block B




Limit Clause

-13 dBm at block edge.

## 2.3 EFFECTIVE ISOTROPIC RADIATED POWER

### 2.3.1 Specification Reference

FCC CFR 47 Part 24, Clause 24.232(c)

### 2.3.2 Equipment Under Test and Modification State

CDMA SHI15 S/N: IMEI 004401114000199 - Modification State 0

### 2.3.3 Date of Test

22 May 2012

### 2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.3.5 Test Procedure

Measurements of the fundamental from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The fundamental frequency was maximised by adjusting the antenna height, antenna polarisation and turntable azimuth. A peak detector was used with the trace set to max hold. The maximum result was recorded.

The EUT was then removed from the chamber and replaced with a substitution antenna. Using a signal generator the level was adjusted to achieve the same value on the measuring instrument as previously recorded with the EUT. The final result (ERP) was determined by a calculation using the signal generator level, antenna gain and cable loss.

The measurements were performed at a 3m distance unless otherwise stated.

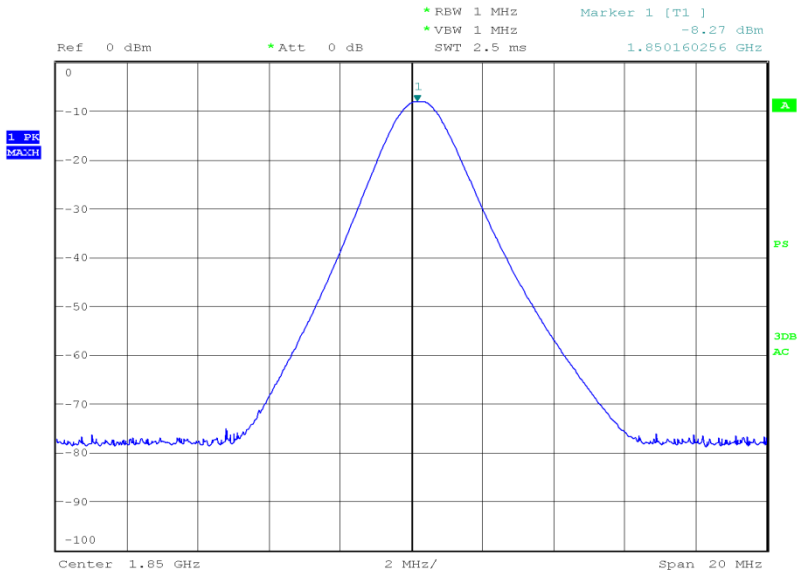
### 2.3.6 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 20.4°C |
| Relative Humidity | 49.0% |

### 2.3.7 Test Results

1850.2 MHz

| Result (dBm) | Result (W) |
|---|---|
| 31.95 | 1.57 |

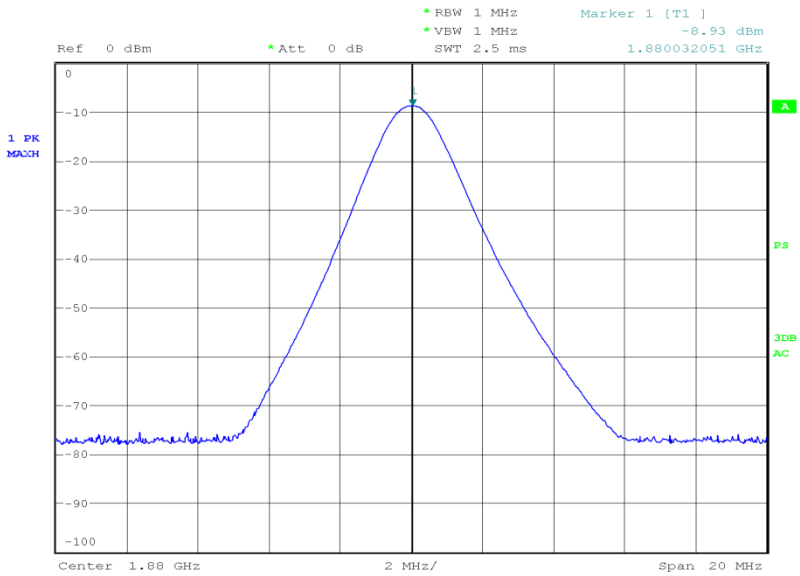



Date: 22.MAY.2012 16:44:02

Product Service

1880.0 MHz

| Result (dBm) | Result (W) |
|---|---|
| 31.81 | 1.52 |

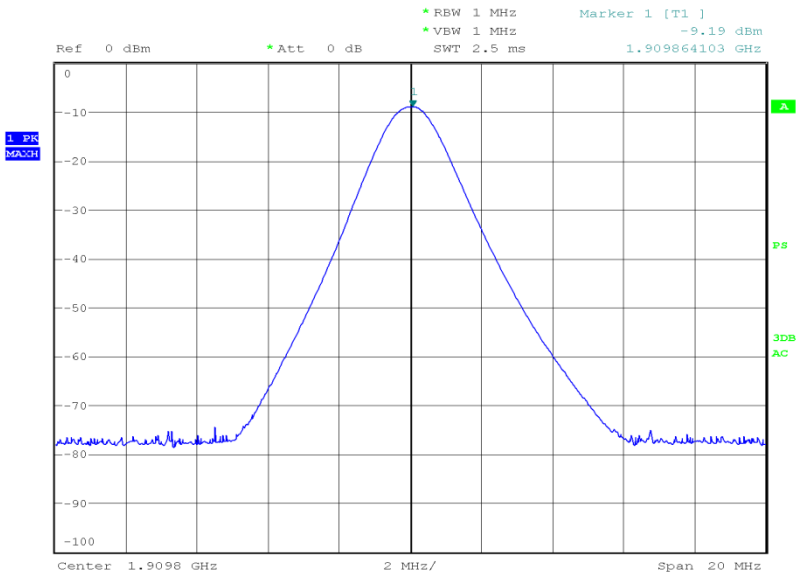



Date: 22.MAY.2012 17:02:06

Product Service

1909.8 MHz

| Result (dBm) | Result (W) |
|---|---|
| 30.59 | 1.15 |




Limit Clause

Mobile – 7 W or 38.45 dBm
Base Stations – 500 W or 57 dBm

## 2.4 MAXIMUM PEAK OUTPUT POWER - CONDUCTED

### 2.4.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1046
FCC CFR 47 Part 24, Clause 24.232

### 2.4.2 Equipment Under Test and Modification State

CDMA SHI15 S/N: IMEI 004401113999888 - Modification State 0

### 2.4.3 Date of Test

12 June 2012

### 2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.4.5 Test Procedure

Using a spectrum analyser and attenuator(s), the output power of the EUT was measured at the antenna terminals.

The EUT was tested in GPRS mode with 2 timeslots active.

The spectrum analyser RBW and VBW were set to 1 MHz and the path loss measured and entered as a reference offset level.

### 2.4.6 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23.4°C |
| Relative Humidity | 35.6% |

### 2.4.7 Test Results

4.0 V DC Supply

1850.2 MHz

| Mode | Result (dBm) | Result (W) |
|---|---|---|
| GMSK | 29.91 | 0.979 |

1880.0 MHz

| Mode | Result (dBm) | Result (W) |
|---|---|---|
| GMSK | 30.33 | 1.08 |

1909.8 MHz

| Mode | Result (dBm) | Result (W) |
|---|---|---|
| GMSK | 30.28 | 1.07 |

Limit Clause

Mobile – 7 W or 38.45 dBm
Base Stations – 500 W or 57 dBm

## 2.5 MODULATION CHARACTERISTICS

### 2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1047(d)

### 2.5.2 Equipment Under Test

CDMA SHI15

### 2.5.3 Test Results

Customer Description

-

Description Of Modulation Technique

The modulation scheme used in GSM is called Gaussian Minimum Shift Keying (GMSK). GMSK facilitates the use of narrow bandwidth and allows for both coherent and non coherent detection capabilities. It is a scheme in which the transitions from One to Zero or Zero to One do not occur quickly, but over a period of time. If pulses are transmitted quickly harmonics are transmitted. The power spectrum for a square wave is rich in harmonics, and the power within the side lobes is wasted, and can be a cause of potential interference.

A method to reduce the harmonics is to round off the edges of the pulses thus lowering the spectral components of the signal. In GSM this is done by using a Gaussian pre-filter which typically has a bandwidth of 81.25kHz. The output from the Gaussian filter then phase modulates the carrier. As there are no dramatic phase transitions of the carrier this gives a constant envelope and low spectral component output from the transmitter.

The spectral efficiency is calculated by

bit rate / Channel bandwidth = 270.83333 kbit/s / 200 kHz = 1.354 bit/s/Hz.

The bandwidth product BT = Bandwidth x bit duration = 81.25 kHz x 3.6923 micros = 0.3

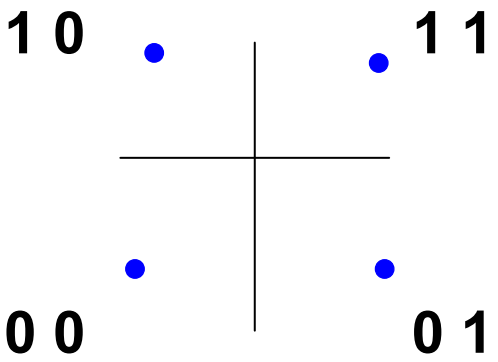
**GMSK OVERVIEW**

The modulation scheme used for the EUT is GMSK.

A brief overview of how GMSK works is shown below.

**GMSK (Gaussian Minimum Shift Keying)**

The fundamental principal behind GMSK is Phase shift keying. This splits a data stream into a series of 2-digit phase shifts, using the following phase shifts to represent data pairs.




Therefore for the BIT sequence 0 0 1 1 1 0 0 1 The corresponding phase shift will be used

| | | | | |
|---|---|---|---|---|
| BIT SEQUENCE | 0 0 | 1 1 | 1 0 | 01 |
| PHASE 225º | 45º | 135º | 315º | |

This is called QPSK (Quadratic Phase Shift Keying)

**<u>However</u>**

There is a problem with QPSK: transition from e.g. 00 to 11 gives phase shift of 180° (π radians). This has the effect of inverting the carrier waveform and this can lead to detection errors at the receiver.

Solution: restrict phase changes to ± 90°

1. Split bitstream into 2 streams e.g.

| | 0 0 | | 1 1 | | 0 1 | | 1 0 | |
|---|---|---|---|---|---|---|---|---|
| I Stream | 0 | | 1 | | 0 | | 1 | |
| Q stream | | 0 | | 1 | | 1 | | 0 |

2. Modulate each stream with PSK (1 = 90° or π/2, 0 = -90° or - π/2 phase shift)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| I Stream | 0 | | 1 | | 0 | | 1 | |
| | -π/2 | | -π/2 | | -π/2 | | π/2 | |
| Q stream | | 0 | | 1 | | 1 | | 0 |
| | | -π/2 | | π/2 | | π/2 | | -π/2 |

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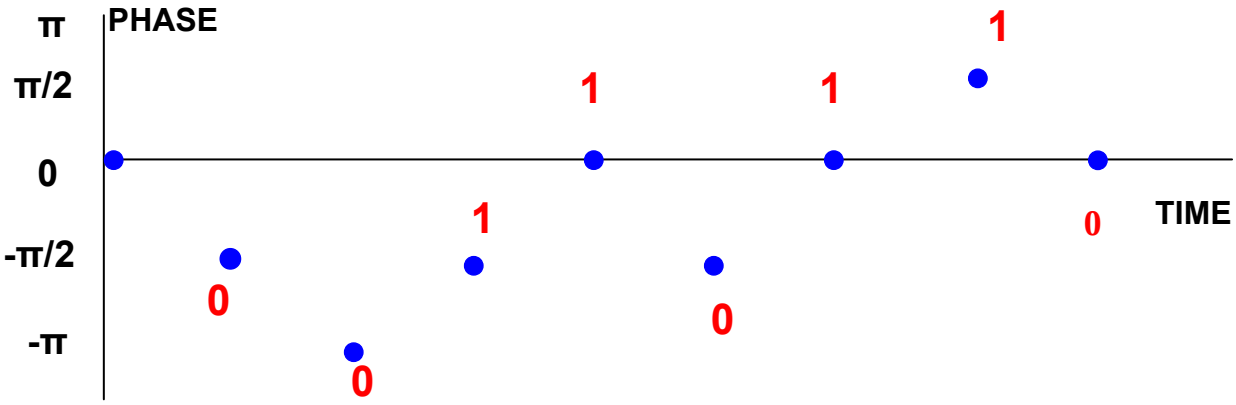
3. Combine (add) the two PSK signals:

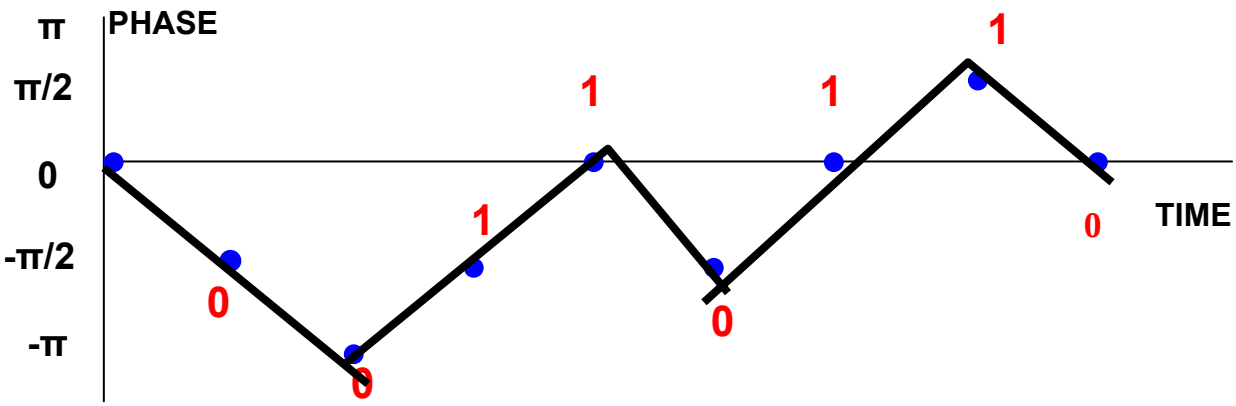
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Combined Phase | -π/2 | -π | -π/2 | 0 | -π/2 | 0 | π/2 | 0 |

Result: offset - QPSK, phase change is restricted to ± π/2 radians:




It would be preferable to have "gradual" changes in place between each pair of bits (Continuous-phase modulation). Replacing each “rectangular” shaped pulse (for 1 or 0) with a sinusoidal pulse can do this:

Result: Minimum Shift Keying (MSK):




**Gaussian Minimum Shift Keying**

MSK has high sidebands relative to the main lobes in the frequency domain - this can lead to interference with adjacent signals.

If the rectangular pulses corresponding to the bitstream are filtering using a Gaussian-shaped impulse response filter, we get Gaussian MSK (GMSK) - this has low sidelobes compared to MSK.

Limit Clause

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

Product Service

## 2.6 EMISSION FOR BROADBAND PCS EQUIPMENT

### 2.6.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 24, Clause 24.238

### 2.6.2 Equipment Under Test and Modification State

CDMA SHI15 S/N: IMEI 004401114000066 - Modification State 0

### 2.6.3 Date of Test

14 May 2012

### 2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.6.5 Test Procedure

A preliminary profile of the Spurious Radiated Emissions was obtained up to the 10th harmonic by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, the list of emissions was then confirmed or updated under Alternative Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

The EUT was set to transmit on full power on WCDMA modulation. The EUT was tested on bottom, middle and top channels at maximum power.

For any emissions found the EUT was then removed from the chamber and replaced with a substitution antenna. Using a signal generator the level was adjusted to achieve the same value on the measuring instrument as previously recorded with the EUT. The final result was determined by a calculation using the signal generator level, antenna gain and cable loss. The measurements were performed at a 3m distance unless otherwise stated.

### 2.6.6 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 20.5°C |
| Relative Humidity | 36.0% |

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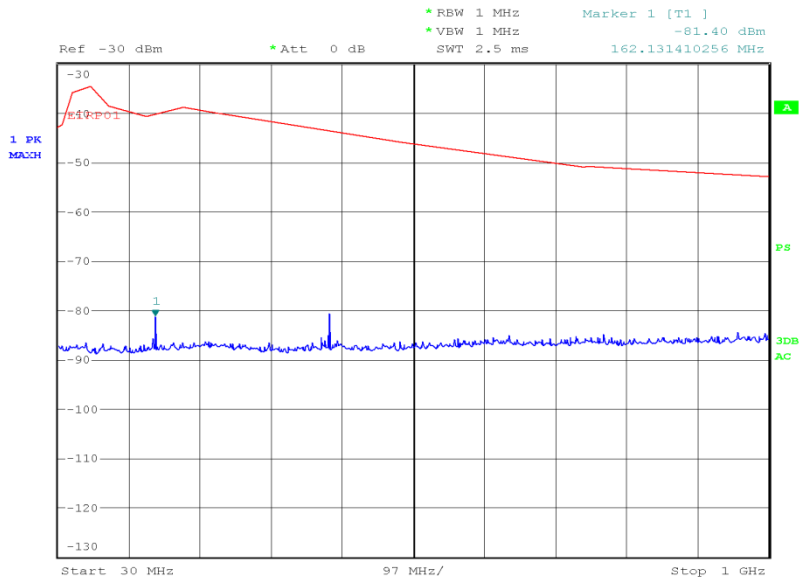
### 2.6.7 Test Results

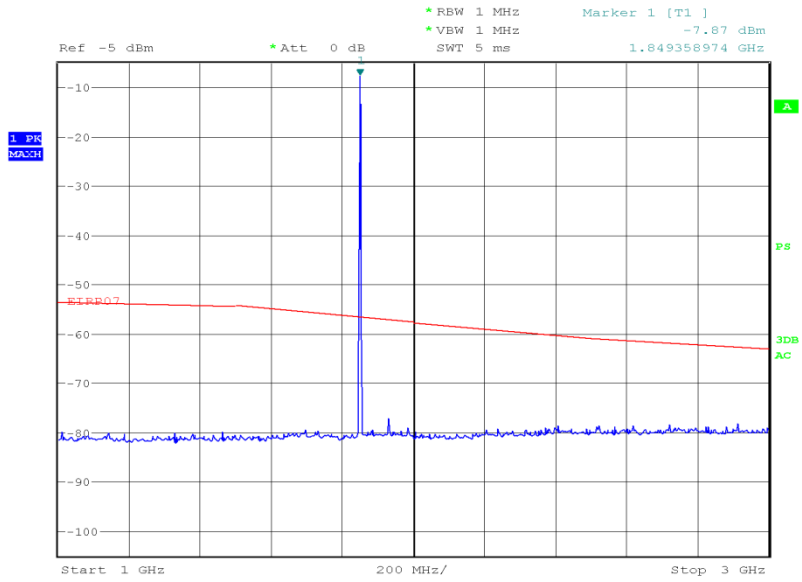
1850.2 MHz

30 MHz to 1 GHz




Date: 14.MAY.2012 22:04:08

1 GHz to 3 GHz




Date: 14.MAY.2012 18:33:41

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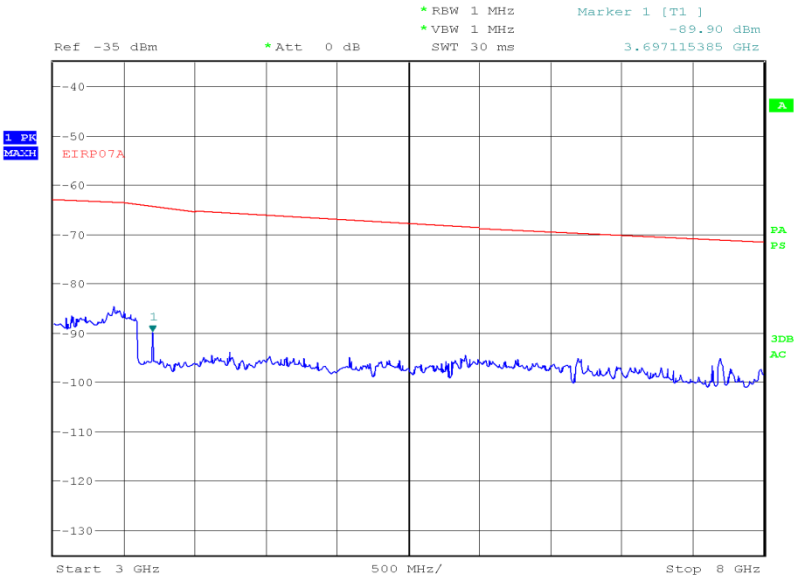
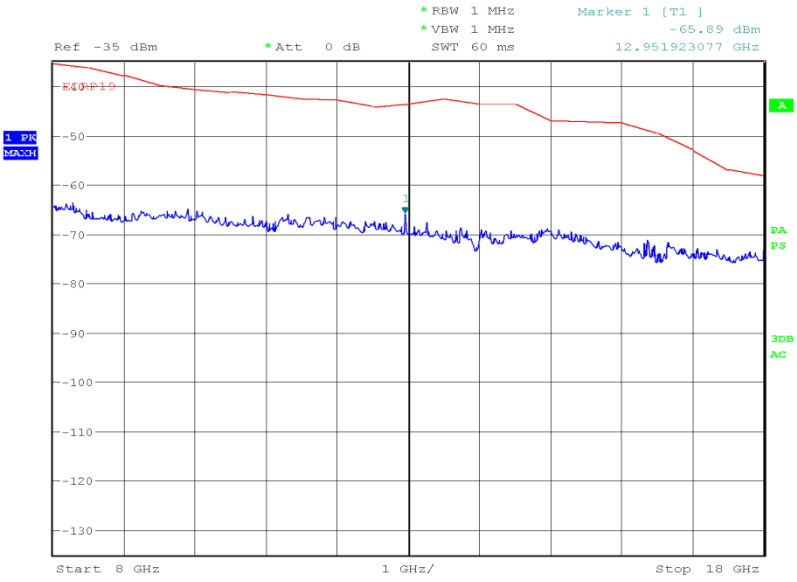
3 GHz to 8 GHz




Date: 14.MAY.2012 18:39:57

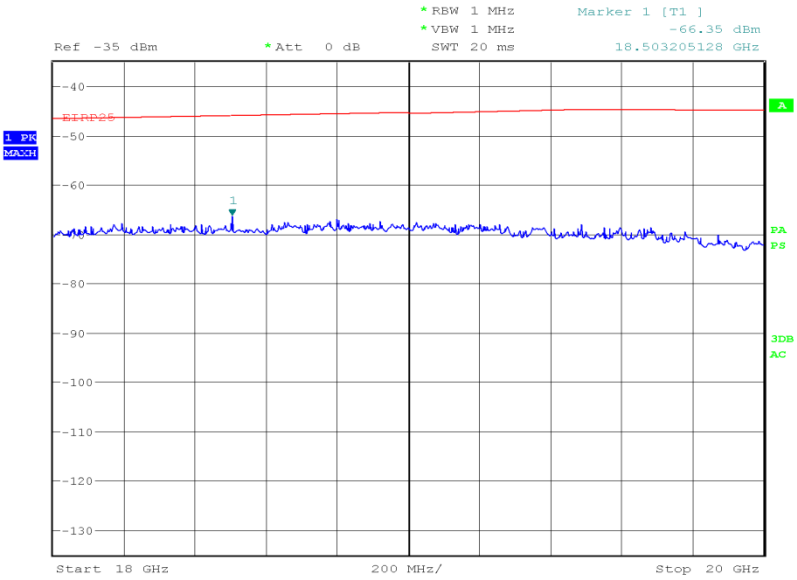
8 GHz to 18 GHz




Date: 14.MAY.2012 20:41:03

Product Service

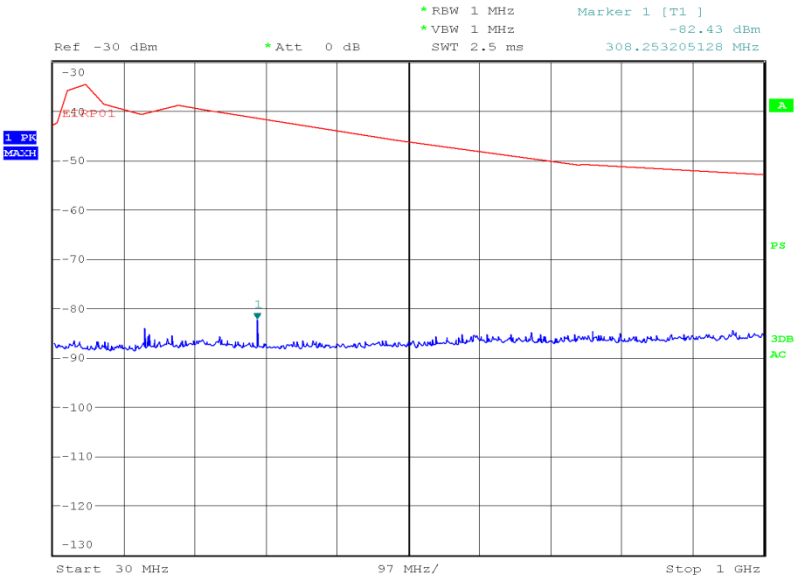
18 GHz to 20 GHz




Date: 14.MAY.2012 21:07:58

1880.0 MHz

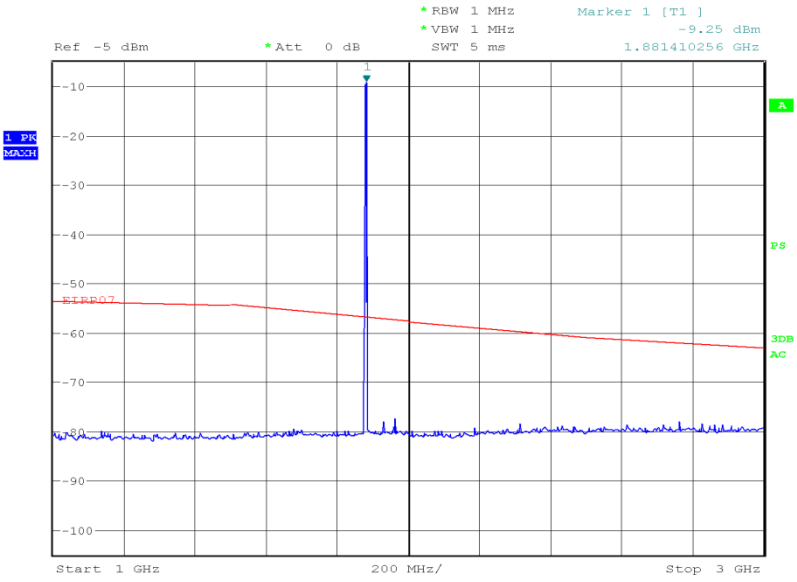
30 MHz to 1 GHz




Date: 14.MAY.2012 22:06:21

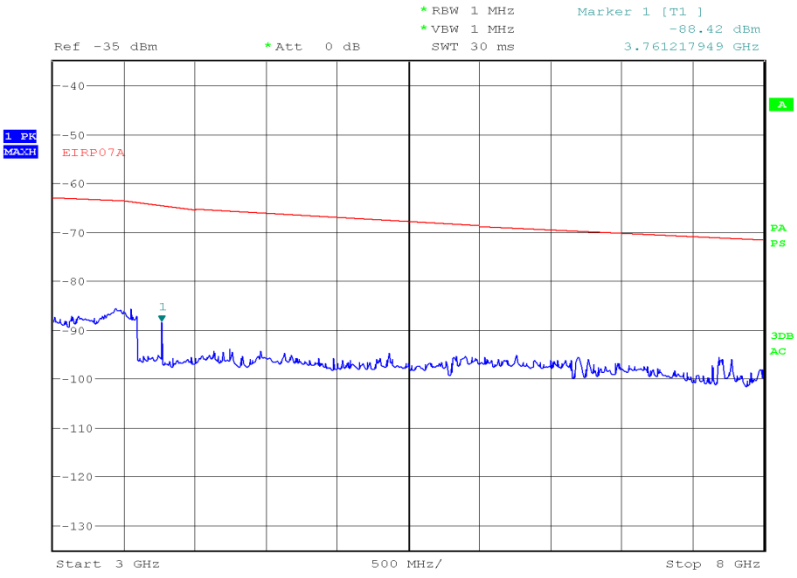
Product Service

1 GHz to 3 GHz




Date: 14.MAY.2012 18:31:38

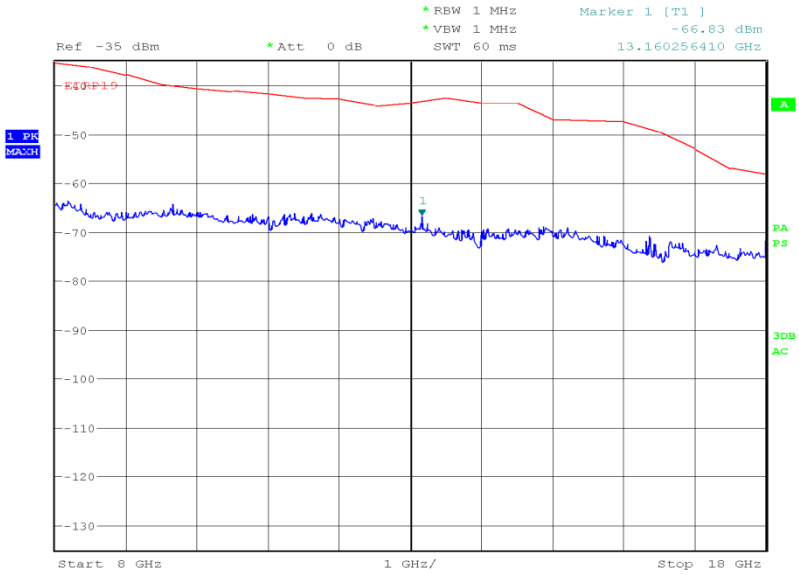
3 GHz to 8 GHz




Date: 14.MAY.2012 18:43:23

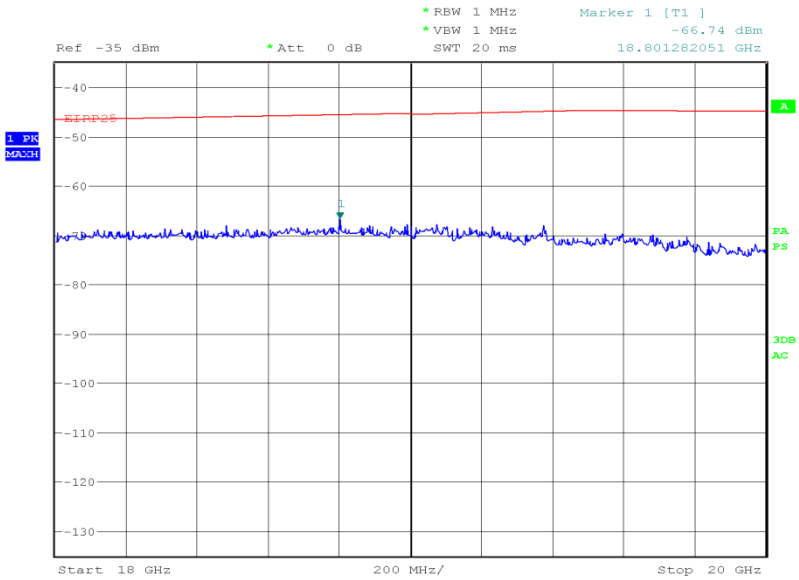
Product Service

8 GHz to 18 GHz




Date: 14.MAY.2012 20:39:16

18 GHz to 20 GHz

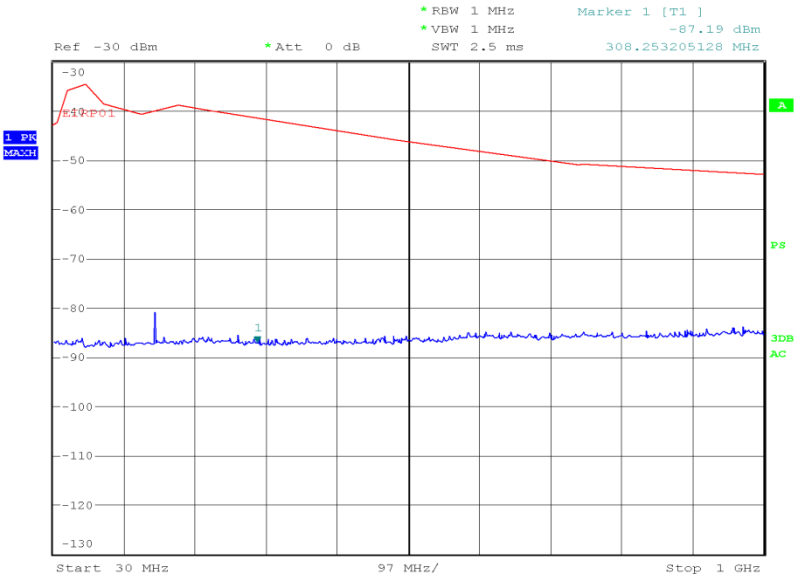



Date: 14.MAY.2012 21:09:51

Product Service

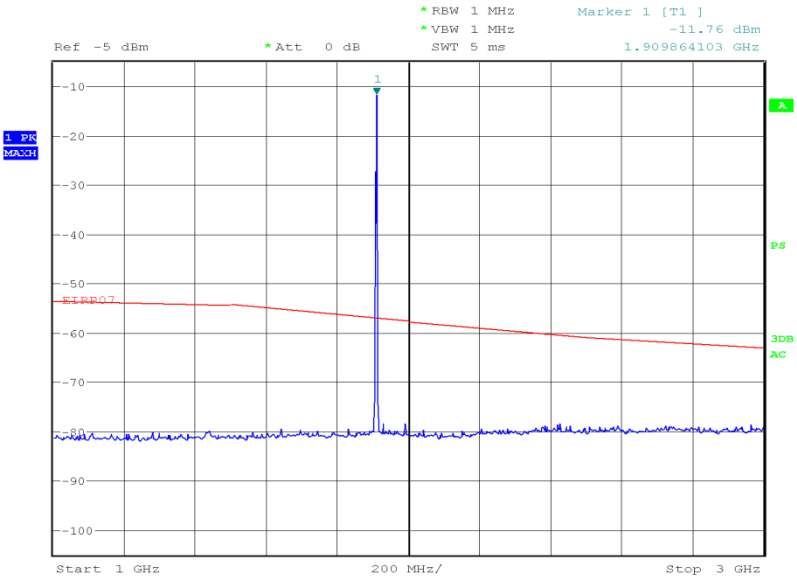
1909.8 MHz

30 MHz to 1 GHz




Date: 14.MAY.2012 22:18:01

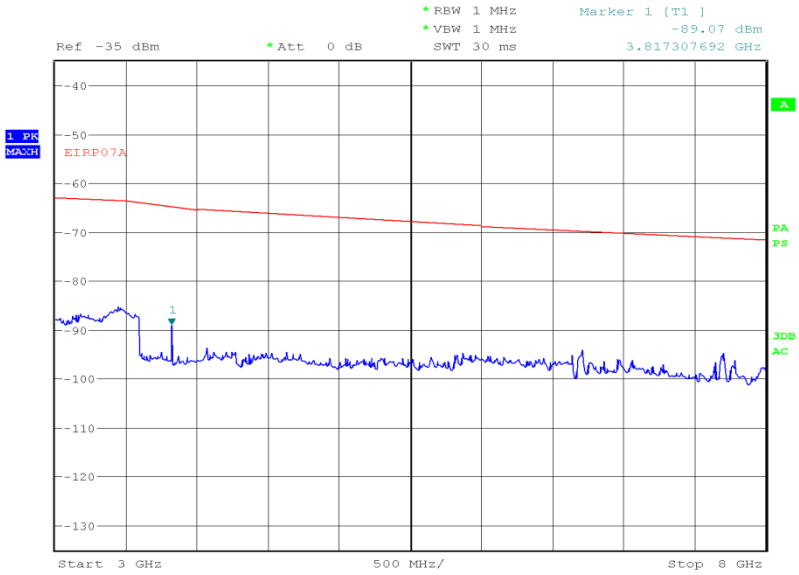
1 GHz to 3 GHz




Date: 14.MAY.2012 18:28:37

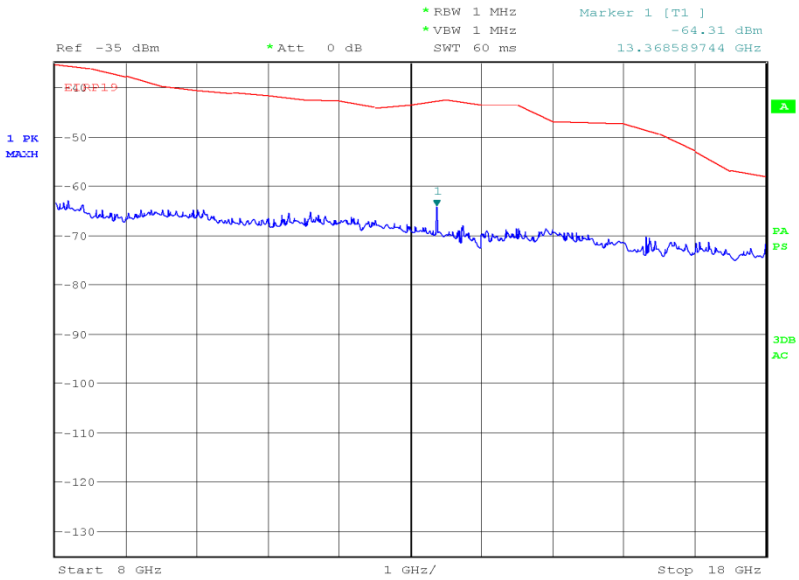
Product Service

3 GHz to 8 GHz




Date: 14.MAY.2012 18:46:35

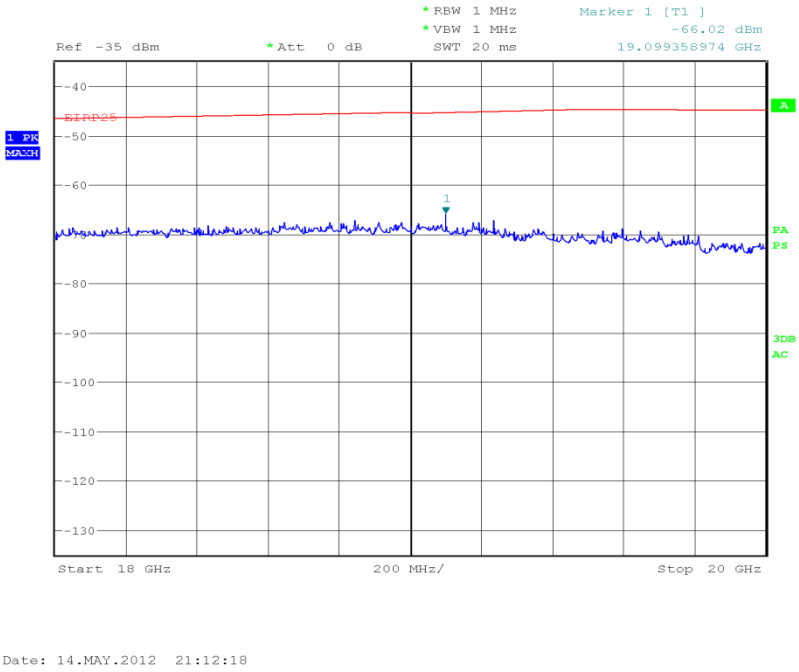
8 GHz to 18 GHz




Date: 14.MAY.2012 20:35:47

Product Service

18 GHz to 20 GHz




Limit Clause

43+10log(P) or -13 dBm

## 2.7 CONDUCTED SPURIOUS EMISSIONS

### 2.7.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 24, Clause 24.238(a)

### 2.7.2 Equipment Under Test and Modification State

CDMA SHI15 S/N: IMEI 004401113999888 - Modification State 0

### 2.7.3 Date of Test

12 June 2012

### 2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.7.5 Test Procedure

In accordance with Part 2.1051, the spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using a combination of filters and attenuators and the frequency spectrum investigated from 9 kHz to 20 GHz. The EUT was set to transmit on full power with WCDMA modulation. The EUT was tested on Bottom, Middle and Top channels for maximum power. The resolution and video bandwidths were set to 1 MHz and 3 MHz thus meeting the requirements of Part 24.238(a). The spectrum analyser detector was set to max hold.

From 9 kHz to 4 GHz, an attenuator was used. For measuring the range 4 GHz to 20 GHz an attenuator and high pass filter were used. This was to reduce saturation effects in the spectrum analyser.

The maximum path loss across the measurement bands were used as reference level offsets to ensure worst case.

### 2.7.6 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23.4°C |
| Relative Humidity | 35.6% |

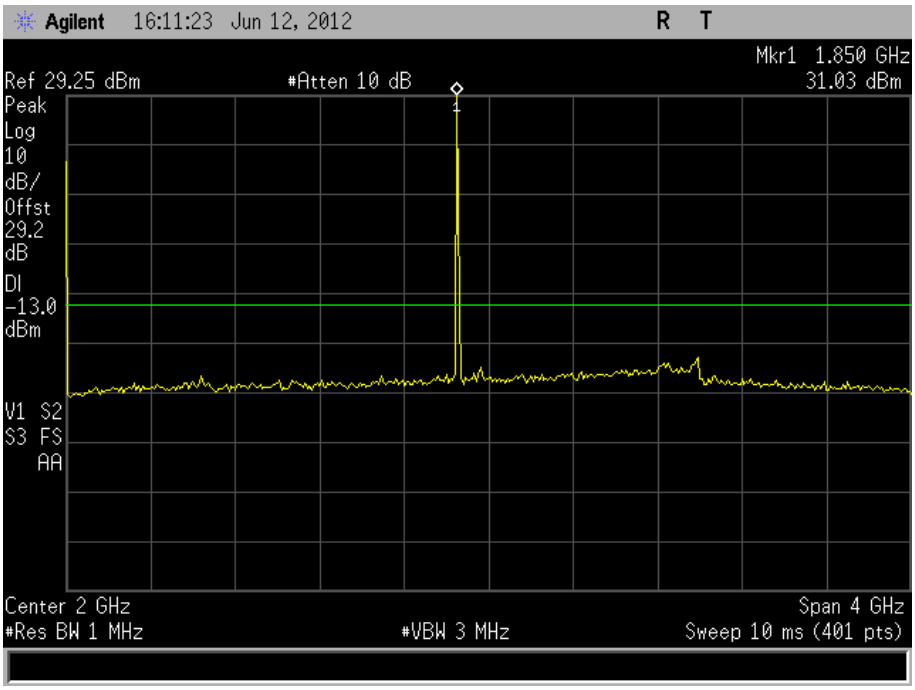
Product Service

### 2.7.7 Test Results

4.0 V DC Supply

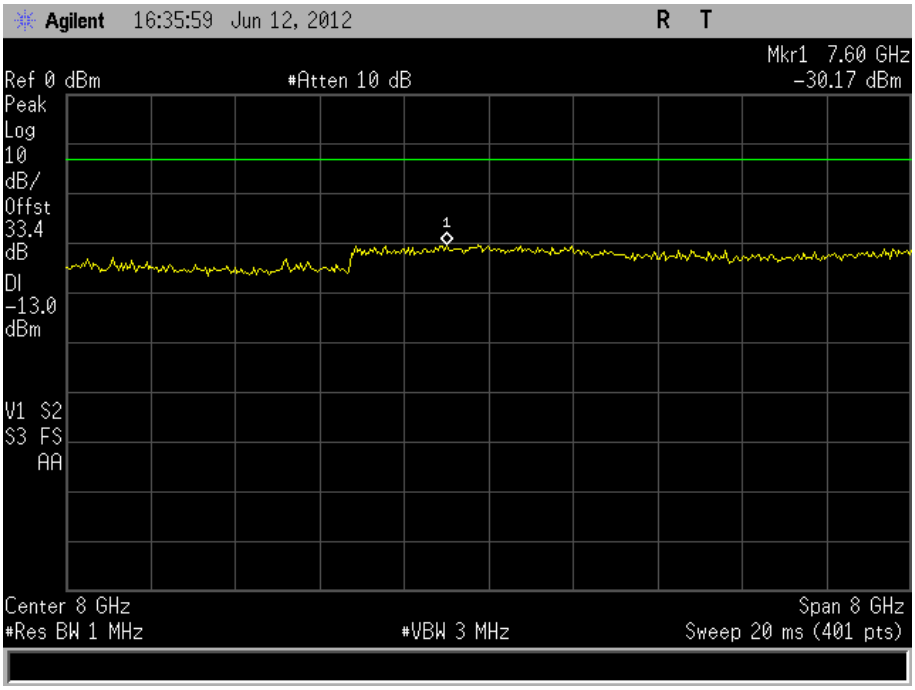
1850.2 MHz

9kHz to 4 GHz

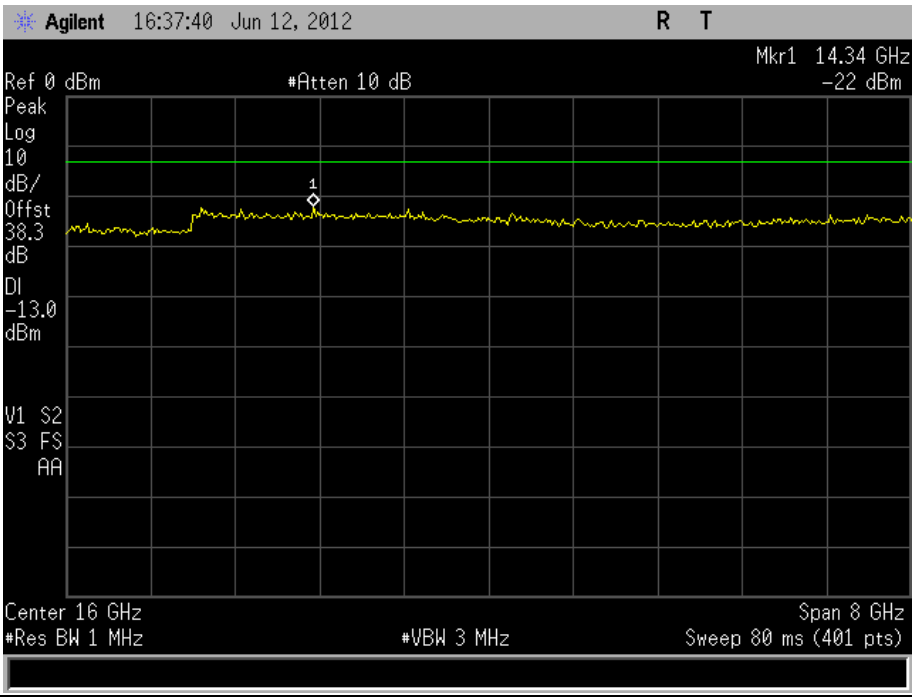


Product Service

4 GHz to 12 GHz



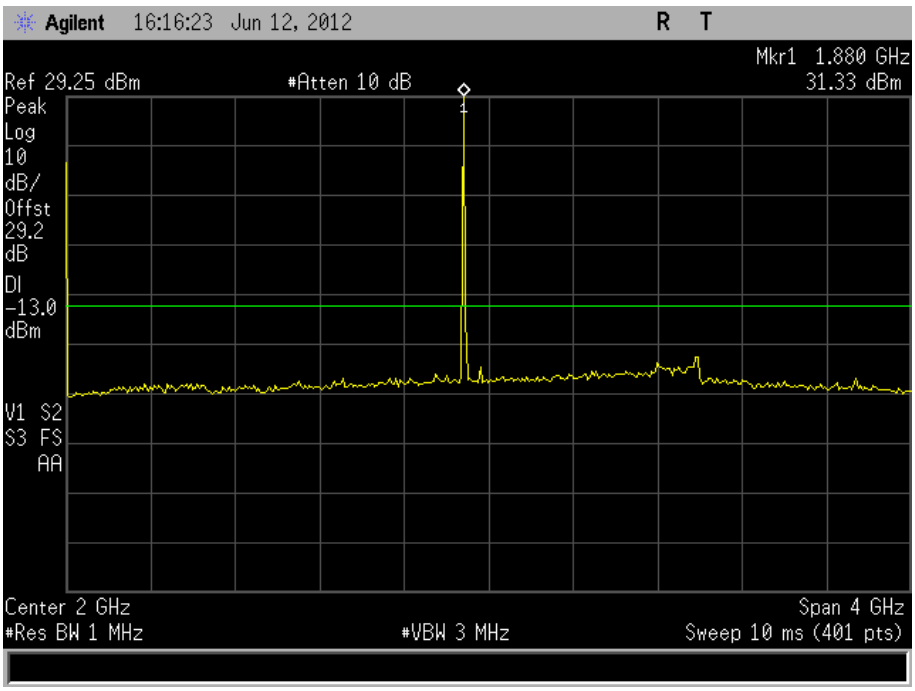

12 GHz to 20 GHz



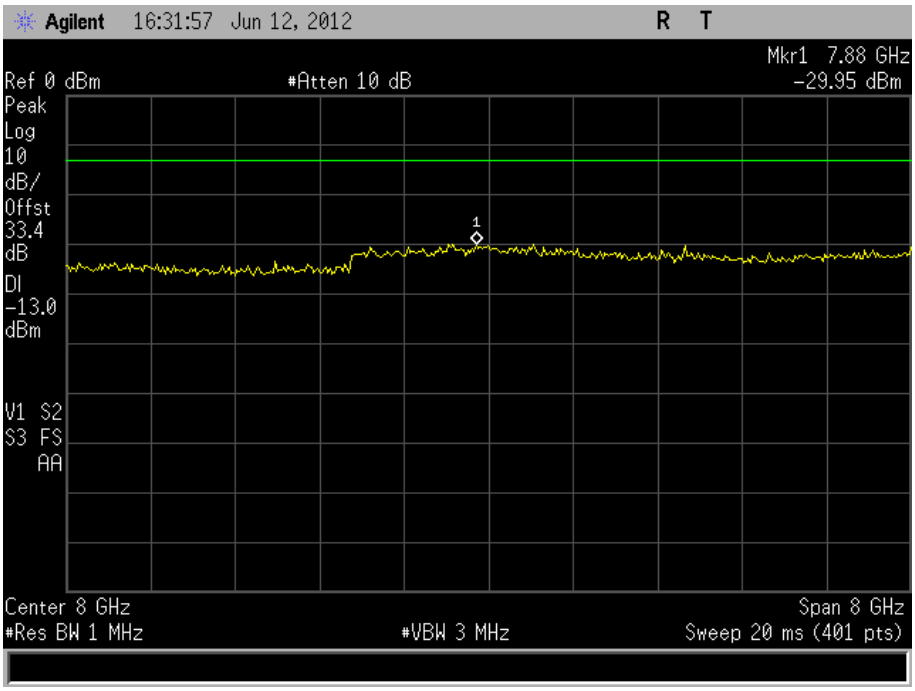
Product Service

1880.0 MHz

9kHz to 4 GHz

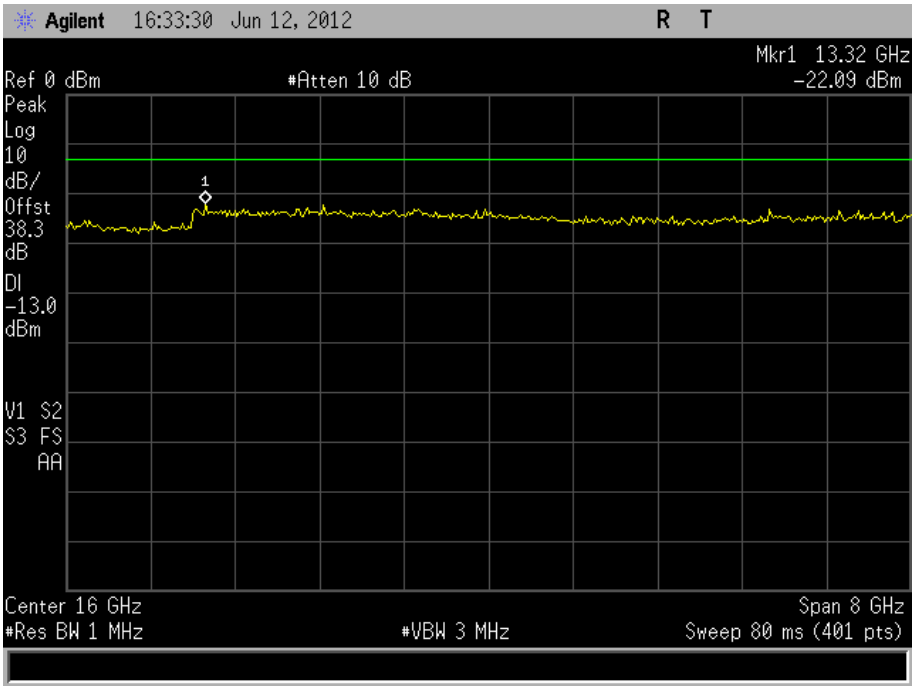



4 GHz to 12 GHz



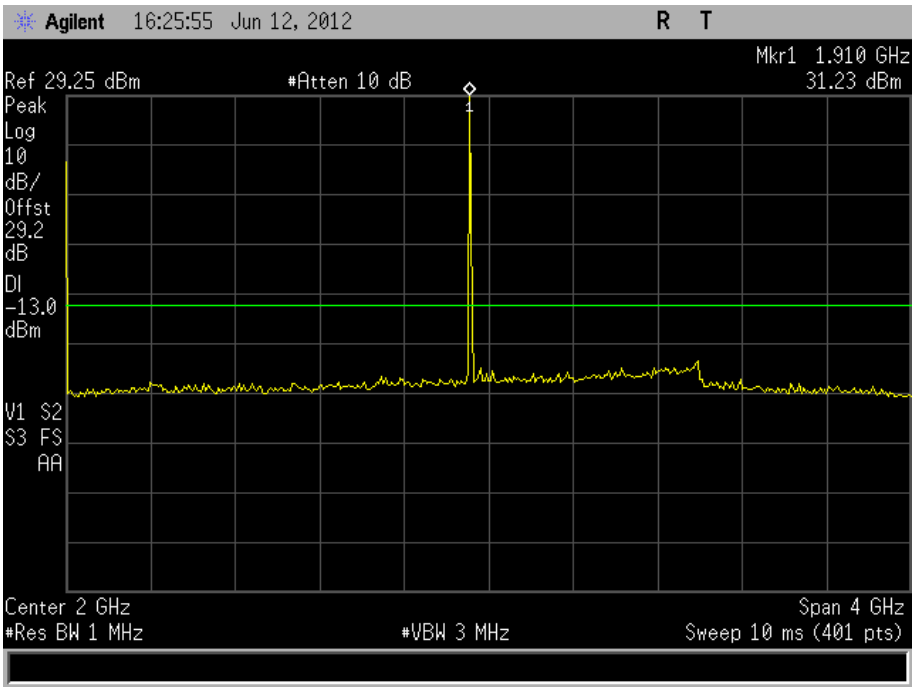
Product Service

12 GHz to 20 GHz



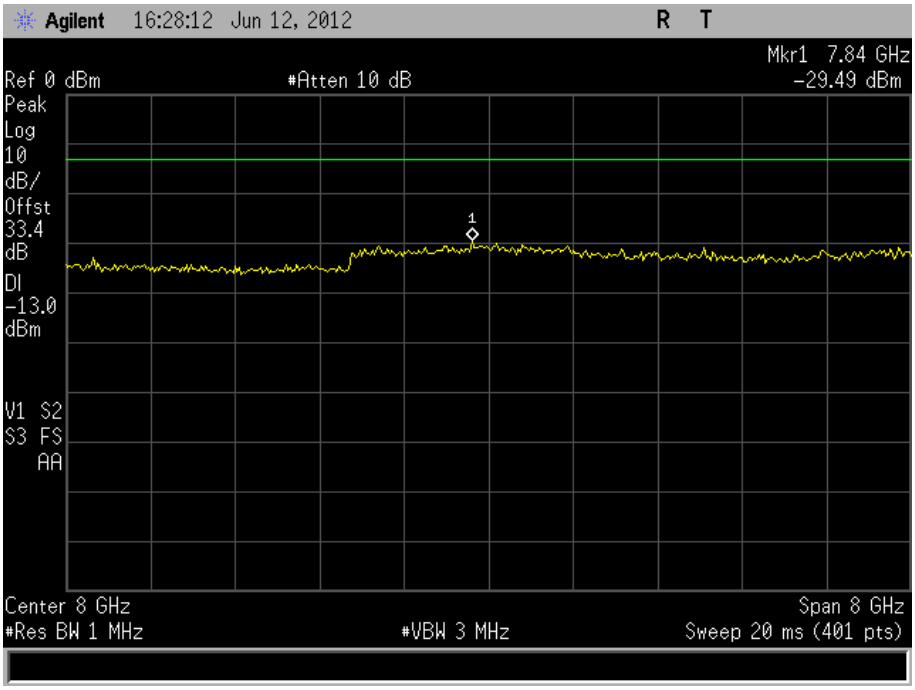

1909.8 MHz

9kHz to 4 GHz

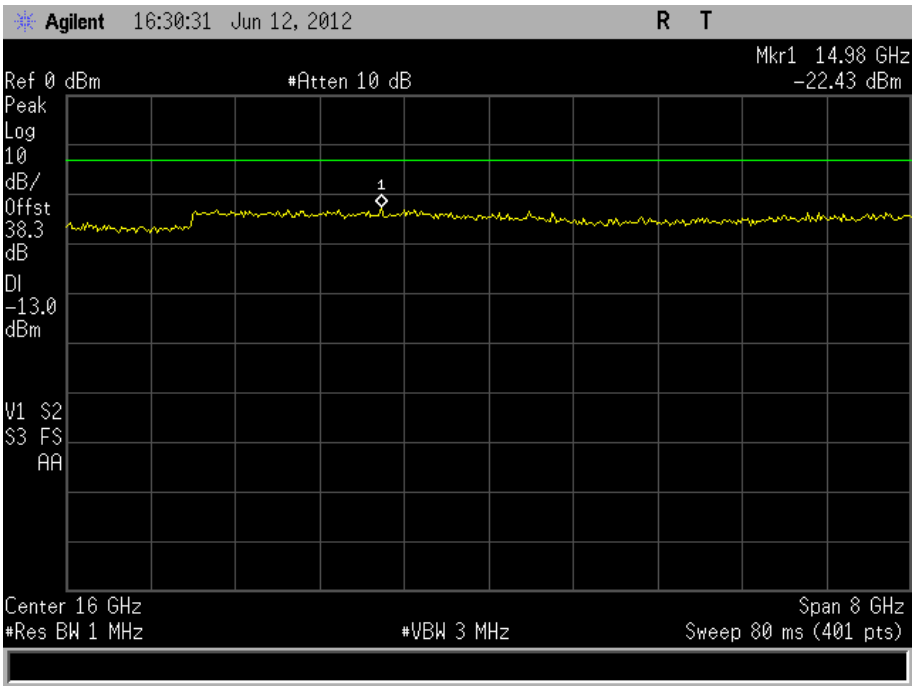


Product Service

4 GHz to 12 GHz




12 GHz to 20 GHz




Limit Clause

43+10log(P) or -13 dBm

## 2.8 OCCUPIED BANDWIDTH

### 2.8.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049(h)
FCC CFR 47 Part 24, Clause 24.238(b)

### 2.8.2 Equipment Under Test and Modification State

CDMA SHI15 S/N: IMEI 004401113999888 - Modification State 0

### 2.8.3 Date of Test

12 June 2012

### 2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.8.5 Test Procedure

The EUT was transmitting at maximum power, with WCDMA modulation. Using a resolution bandwidth of 10 kHz and a video bandwidth of 30 kHz, the -26 dBc points were established and the emission bandwidth determined.

The plot of the following pages shows the resultant display from the Spectrum Analyser.

### 2.8.6 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23.4°C |
| Relative Humidity | 35.6% |

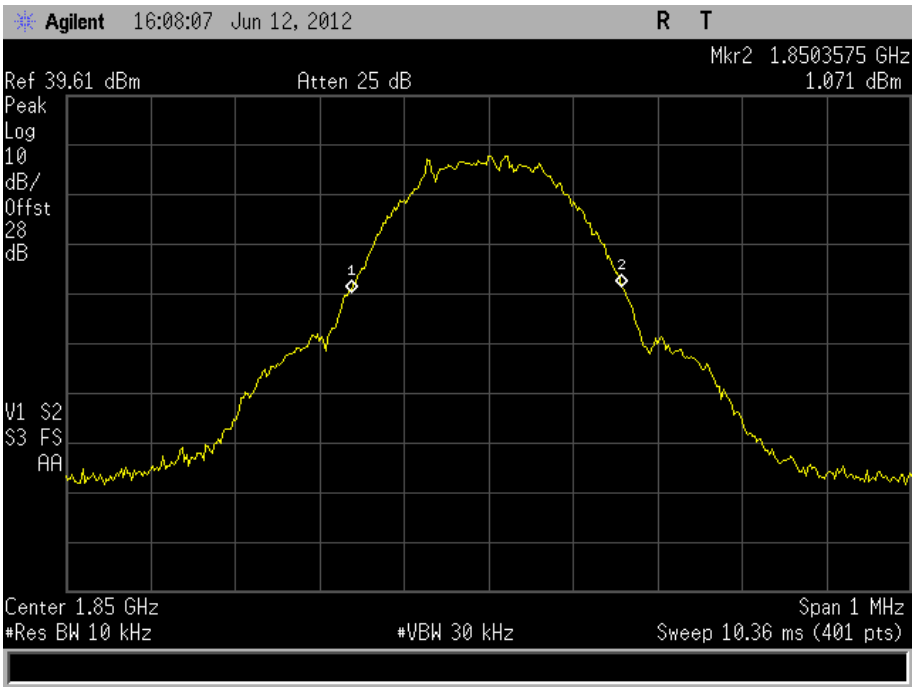
Product Service

### 2.8.7 Test Results

4.0 V DC Supply

1850.2 MHz

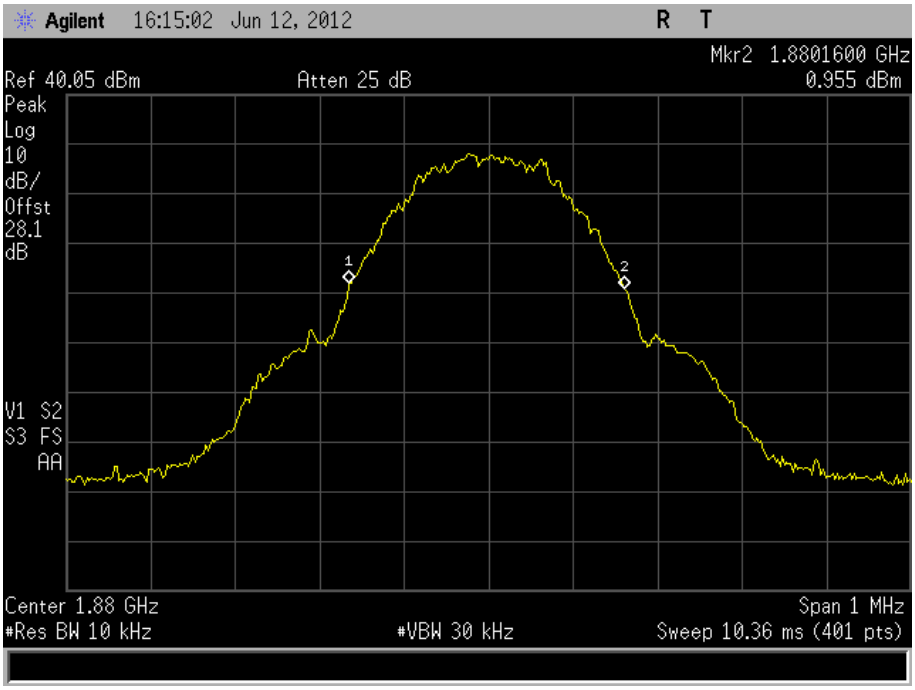
| Mode | Occupied Bandwidth (kHz) |
|---|---|
| GMSK | 320 |



Product Service

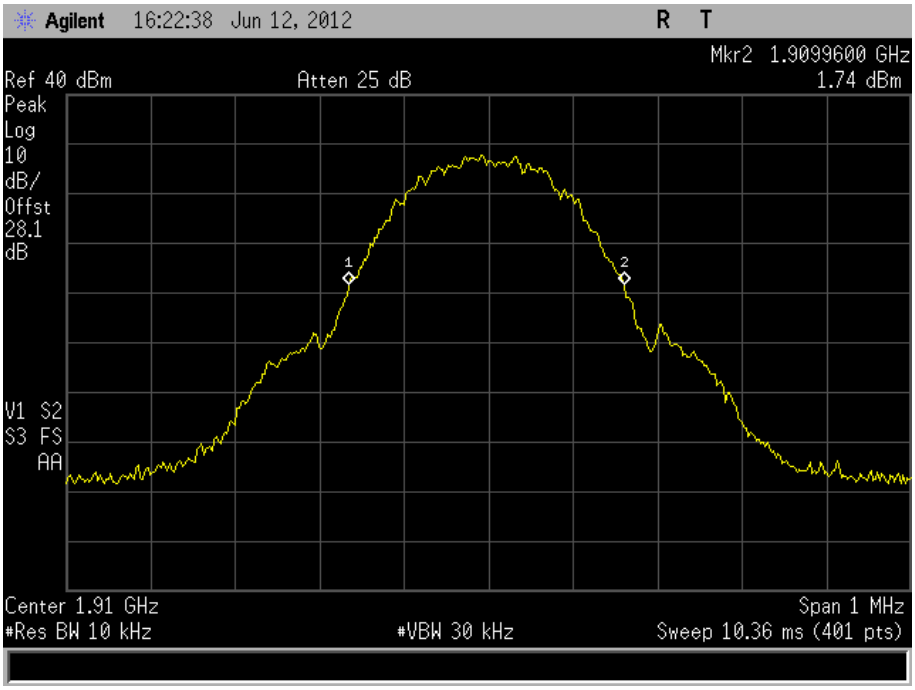
1880.0 MHz

| Mode | Occupied Bandwidth (kHz) |
|---|---|
| GMSK | 325 |



1909.8 MHz

| Mode | Occupied Bandwidth (kHz) |
|---|---|
| GMSK | 325 |




Limit Clause

The occupied bandwidth, that is the frequency bandwidth such that, below is lower and above is upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.

Product Service

# SECTION 3

# TEST EQUIPMENT USED

Product Service

## 3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

| Instrument | Manufacturer | Type No. | TE No. | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| **Section 2.1 - Frequency Stability** | | | | | |
| Digital Temperature Indicator + T/C | Fluke | 51 | 412 | 12 | 6-Jan-2013 |
| Dual programable power supply | Thurlby | T-1000 | 418 | - | TU |
| Temperature Chamber | Montford | 2F3 | 467 | - | O/P Mon |
| Rubidium Standard | Rohde & Schwarz | XSRM | 1316 | 12 | 13-Sep-2012 |
| Attenuator (20dB, 2W) | Pasternack | PE 7004-20 | 2943 | 12 | 27-Mar-2013 |
| Radio Communications Test Set | Rohde & Schwarz | CMU 200 | 3035 | 12 | 7-Oct-2012 |
| True RMS Multimeter | Fluke | 179 | 4007 | 12 | 16-Feb-2013 |
| Temperature Humidity Meter | Radio Spares | 1260 | 4020 | 12 | 23-Nov-2012 |
| **Section 2.2 – Spurious Emissions at Band Edge** | | | | | |
| Dual programable power supply | Thurlby | T-1000 | 418 | - | TU |
| Multimeter | Fluke | 75 Mk3 | 455 | 12 | 16-Jan-2013 |
| Attenuator (10dB, 10W) | Weinschel | 23-10-34 | 470 | 12 | 23-Jun-2012 |
| Attenuator (10dB) | Weinschel | 47-10-34 | 481 | 12 | 27-Mar-2013 |
| Attenuator (20dB/ 2W) | Pasternack | PE7004-20 | 489 | 12 | 21-Sep-2012 |
| Power Divider | Weinschel | 1506A | 604 | 12 | 19-Mar-2013 |
| Spectrum Analyser | Hewlett Packard | E4407B | 1154 | 12 | 28-Jun-2012 |
| Rubidium Standard | Rohde & Schwarz | XSRM | 1316 | 12 | 13-Sep-2012 |
| Radio Communications Test Set | Rohde & Schwarz | CMU 200 | 3035 | 12 | 7-Oct-2012 |
| Network Analyser | Rohde & Schwarz | ZVA 40 | 3548 | 12 | 13-Mar-2013 |
| Temperature Humidity Meter | Radio Spares | 1260 | 4020 | 12 | 23-Nov-2012 |
| **Section 2.3 – Effective Isotropic Radiated Power** | | | | | |
| Peak Power Analyser | Hewlett Packard | 8990A | 107 | 12 | 10-Feb-2013 |
| Antenna (Double Ridge Guide, 1GHz-18GHz) | EMCO | 3115 | 234 | 12 | 8-Dec-2012 |
| Antenna (Double Ridge Guide, 1GHz-18GHz) | EMCO | 3115 | 235 | 12 | 14-Nov-2012 |
| Screened Room (5) | Rainford | Rainford | 1545 | 36 | 3-Feb-2014 |
| Mast Controller | Inn-Co GmbH | CO 1000 | 1606 | - | TU |
| Power Sensor | Hewlett Packard | 84812A | 2743 | - | TU |
| Signal Generator: 10MHz to 20GHz | Rohde & Schwarz | SMR20 | 3475 | 12 | 20-Dec-2012 |
| EMI Test Receiver | Rohde & Schwarz | ESU40 | 3506 | 12 | 29-Sep-2012 |
| 7m Armoured RF Cable | SSI Cable Corp. | 1501-13-13-7m WA(-) | 3600 | - | TU |
| '3.5mm' - '3.5mm' RF Cable (2m) | Rhophase | 3PS-1803-2000-3PS | 3702 | 12 | 27-Jan-2013 |
| '3.5mm' - '3.5mm' RF Cable (2m) | Rhophase | 3PS-1803-2000-3PS | 3703 | - | TU |
| 9m RF Cable (N Type) | Rhophase | NPS-2303-9000-NPS | 3791 | 12 | 26-Aug-2012 |
| Tilt Antenna Mast | maturo Gmbh | TAM 4.0-P | 3916 | - | TU |
| Mast Controller | maturo Gmbh | NCD | 3917 | - | TU |

Product Service

| Instrument | Manufacturer | Type No. | TE No. | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| **Section 2.4 – Maximum Peak Output Power - Conducted** | | | | | |
| Dual programable power supply | Thurlby | T-1000 | 418 | - | TU |
| Multimeter | Fluke | 75 Mk3 | 455 | 12 | 16-Jan-2013 |
| Attenuator (10dB, 10W) | Weinschel | 23-10-34 | 470 | 12 | 23-Jun-2012 |
| Attenuator (10dB) | Weinschel | 47-10-34 | 481 | 12 | 27-Mar-2013 |
| Attenuator (20dB/ 2W) | Pasternack | PE7004-20 | 489 | 12 | 21-Sep-2012 |
| Power Divider | Weinschel | 1506A | 604 | 12 | 19-Mar-2013 |
| Power Splitter | Weinschel | 1506A | 606 | 12 | 19-Dec-2012 |
| Spectrum Analyser | Hewlett Packard | E4407B | 1154 | 12 | 28-Jun-2012 |
| GPS Frequency Standard | Rapco | GPS-804/3 | 1312 | 12 | 13-Sep-2012 |
| Rubidium Standard | Rohde & Schwarz | XSRM | 1316 | 12 | 13-Sep-2012 |
| Hygromer | Rotronic | A1 | 2677 | 12 | 7-Feb-2013 |
| Radio Communications Test Set | Rohde & Schwarz | CMU 200 | 3035 | 12 | 7-Oct-2012 |
| Network Analyser | Rohde & Schwarz | ZVA 40 | 3548 | 12 | 13-Mar-2013 |
| '3.5mm' - '3.5mm' RF Cable (1m) | Rhophase | 3PS-1803-1000-3PS | 3696 | 12 | 27-Jan-2013 |
| DC - 12.4 GHz 10 dB Attenuator | Suhner | 6810.17.A | 3965 | 12 | 24-Jun-2012 |
| P-Series Power Meter | Agilent | N1911A | 3981 | 12 | 12-Sep-2012 |
| 50 MHz-18 GHz Wideband Power Sensor | Agilent | N1921A | 3983 | 12 | 12-Sep-2012 |
| True RMS Multimeter | Fluke | 179 | 4007 | 12 | 16-Feb-2013 |
| Temperature Humidy Meter | Radio Spares | 1260 | 4020 | 12 | 23-Nov-2012 |
| **Section 2.6 – Emission for Broadband PCS Equipment** | | | | | |
| Antenna (Double Ridge Guide) | Link Microtek Ltd | AM180HA-K-TU2 | 230 | 24 | 13-Sep-2013 |
| Antenna (Double Ridge Guide, 1GHz-18GHz) | EMCO | 3115 | 234 | 12 | 8-Dec-2012 |
| Antenna (Double Ridge Guide, 1GHz-18GHz) | EMCO | 3115 | 235 | 12 | 14-Nov-2012 |
| Antenna (Double Ridge Guide) | Q-Par Angus Ltd | QSH 180K | 1511 | 24 | 2-Aug-2012 |
| Pre-Amplifier | Phase One | PS04-0086 | 1533 | 12 | 20-Sep-2012 |
| Pre-Amplifier | Phase One | PSO4-0087 | 1534 | 12 | 26-Sep-2012 |
| Screened Room (5) | Rainford | Rainford | 1545 | 36 | 3-Feb-2014 |
| Mast Controller | Inn-Co GmbH | CO 1000 | 1606 | - | TU |
| Antenna (Bilog) | Chase | CBL6143 | 2904 | 24 | 12-May-2013 |
| Signal Generator: 10MHz to 20GHz | Rohde & Schwarz | SMR20 | 3475 | 12 | 20-Dec-2012 |
| EMI Test Receiver | Rohde & Schwarz | ESU40 | 3506 | 12 | 29-Sep-2012 |
| 3 GHz High Pass Filter | K&L Microwave | 11SH10-3000/X18000-O/O | 3552 | 12 | 16-Apr-2013 |
| 7m Armoured RF Cable | SSI Cable Corp. | 1501-13-13-7m WA(-) | 3600 | - | TU |
| '2.92mm' - '2.92mm' RF Cable (2m) | Rhophase | KPS-1503-2000-KPS | 3694 | - | TU |
| '2.92mm' - '2.92mm' RF Cable (2m) | Rhophase | KPS-1503-2000-KPS | 3695 | - | TU |
| '3.5mm' - '3.5mm' RF Cable (2m) | Rhophase | 3PS-1803-2000-3PS | 3702 | 12 | 27-Jan-2013 |
| '3.5mm' - '3.5mm' RF Cable (2m) | Rhophase | 3PS-1803-2000-3PS | 3703 | - | TU |
| 9m RF Cable (N Type) | Rhophase | NPS-2303-9000-NPS | 3791 | 12 | 26-Aug-2012 |
| Tilt Antenna Mast | maturo Gmbh | TAM 4.0-P | 3916 | - | TU |
| Mast Controller | maturo Gmbh | NCD | 3917 | - | TU |
| Low Noise Amplifier | Wright Technologies | APS04-0085 | 3969 | 12 | 8-Jul-2012 |

Product Service

| Instrument | Manufacturer | Type No. | TE No. | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| **Section 2.7 - Conducted Spurious Emissions** | | | | | |
| Dual programable power supply | Thurlby | T-1000 | 418 | - | TU |
| Multimeter | Fluke | 75 Mk3 | 455 | 12 | 16-Jan-2013 |
| Attenuator (10dB, 10W) | Weinschel | 23-10-34 | 470 | 12 | 23-Jun-2012 |
| Attenuator (10dB) | Weinschel | 47-10-34 | 481 | 12 | 27-Mar-2013 |
| Attenuator (20dB/ 2W) | Pasternack | PE7004-20 | 489 | 12 | 21-Sep-2012 |
| Power Divider | Weinschel | 1506A | 604 | 12 | 19-Mar-2013 |
| Spectrum Analyser | Hewlett Packard | E4407B | 1154 | 12 | 28-Jun-2012 |
| GPS Frequency Standard | Rapco | GPS-804/3 | 1312 | 12 | 13-Sep-2012 |
| Rubidium Standard | Rohde & Schwarz | XSRM | 1316 | 12 | 13-Sep-2012 |
| Hygromer | Rotronic | A1 | 2677 | 12 | 7-Feb-2013 |
| High Pass Filter (4GHz) | RLC Electronics | F-100-4000-5-R | 2773 | 12 | 20-Sep-2012 |
| Filter | Daden Anthony Ass | MH-1500-7SS | 2778 | 12 | 21-Dec-2012 |
| Attenuator (20dB, 20W) | Weinschel | 1 | 3032 | - | TU |
| Radio Communications Test Set | Rohde & Schwarz | CMU 200 | 3035 | 12 | 7-Oct-2012 |
| Signal Generator (10MHz to 40GHz) | Rohde & Schwarz | SMR40 | 3171 | 12 | 22-Aug-2012 |
| Network Analyser | Rohde & Schwarz | ZVA 40 | 3548 | 12 | 13-Mar-2013 |
| '3.5mm' - '3.5mm' RF Cable (1m) | Rhophase | 3PS-1803-1000-3PS | 3696 | 12 | 27-Jan-2013 |
| DC - 12.4 GHz 10 dB Attenuator | Suhner | 6810.17.A | 3965 | 12 | 24-Jun-2012 |
| True RMS Multimeter | Fluke | 179 | 4007 | 12 | 16-Feb-2013 |
| Temperature Humidy Meter | Radio Spares | 1260 | 4020 | 12 | 23-Nov-2012 |
| **Section 2.8 - Occupied Bandwidth** | | | | | |
| Dual programable power supply | Thurlby | T-1000 | 418 | - | TU |
| Multimeter | Fluke | 75 Mk3 | 455 | 12 | 16-Jan-2013 |
| Attenuator (10dB, 10W) | Weinschel | 23-10-34 | 470 | 12 | 23-Jun-2012 |
| Attenuator (10dB) | Weinschel | 47-10-34 | 481 | 12 | 27-Mar-2013 |
| Attenuator (20dB/ 2W) | Pasternack | PE7004-20 | 489 | 12 | 21-Sep-2012 |
| Power Divider | Weinschel | 1506A | 604 | 12 | 19-Mar-2013 |
| Power Splitter | Weinschel | 1506A | 606 | 12 | 19-Dec-2012 |
| Spectrum Analyser | Hewlett Packard | E4407B | 1154 | 12 | 28-Jun-2012 |
| GPS Frequency Standard | Rapco | GPS-804/3 | 1312 | 12 | 13-Sep-2012 |
| Rubidium Standard | Rohde & Schwarz | XSRM | 1316 | 12 | 13-Sep-2012 |
| Hygromer | Rotronic | A1 | 2677 | 12 | 7-Feb-2013 |
| Radio Communications Test Set | Rohde & Schwarz | CMU 200 | 3035 | 12 | 7-Oct-2012 |
| Network Analyser | Rohde & Schwarz | ZVA 40 | 3548 | 12 | 13-Mar-2013 |
| '3.5mm' - '3.5mm' RF Cable (1m) | Rhophase | 3PS-1803-1000-3PS | 3696 | 12 | 27-Jan-2013 |
| DC - 12.4 GHz 10 dB Attenuator | Suhner | 6810.17.A | 3965 | 12 | 24-Jun-2012 |
| True RMS Multimeter | Fluke | 179 | 4007 | 12 | 16-Feb-2013 |
| Temperature Humidity Meter | Radio Spares | 1260 | 4020 | 12 | 23-Nov-2012 |

TU – Traceability Unscheduled
O/P MON – Output Monitored with Calibrated Equipment

Product Service

## 3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

| Test Discipline | MU |
|---|---|
| Maximum Peak Output Power - Conducted | ± 0.70 dB |
| Emission for Broadband PCS Equipment | ± 3.08 dB |
| Conducted Spurious Emissions | ± 3.454 dB |
| Effective Isotropic Radiated Power | ± 3.08 dB |
| Spurious Emissions at Band Edge | ± 2.20 dB |
| Occupied Bandwidth | ± 10.14 kHz |
| Frequency Stability | ± 99.54 Hz |

Product Service

# SECTION 4

# ACCREDITATION, DISCLAIMERS AND COPYRIGHT

## 4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

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