Product Service

Choose certainty.
Add value.

Report On

FCC Testing of the
Sharp SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) and GPS
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24

COMMERCIAL-IN-CONFIDENCE
FCC ID: APYHRO00192

Document 75920802 Report 13 Issue 1 June 2013

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

REPORT ON

FCC Testing of the
Sharp SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) and GPS
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24

Document 75920802 Report 13 Issue 1

June 2013

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 27 June 2013

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);

M Russell G Lawler

Product Service

CONTENTS

Section		Page No
1	**REPORT SUMMARY**	**3**
1.1	Introduction	4
1.2	Brief Summary of Results	5
1.3	Product Technical Description	6
1.4	Product Information	6
1.5	Test Conditions	6
1.6	Deviations from the Standard	6
1.7	Modification Record	6
2	**TEST DETAILS**	**7**
2.1	Frequency Stability	8
2.2	Spurious Emissions at Band Edge	10
2.3	Effective Isotropic Radiated Power	13
2.4	Modulation Characteristics	17
2.5	Maximum Peak Output Power - Conducted	20
2.6	Emission for Broadband PCS Equipment	22
2.7	Conducted Spurious Emissions	31
2.8	Occupied Bandwidth	37
3	**TEST EQUIPMENT USED**	**41**
3.1	Test Equipment Used	42
3.2	Measurement Uncertainty	45
4	**ACCREDITATION, DISCLAIMERS AND COPYRIGHT**	**46**
4.1	Accreditation, Disclaimers and Copyright	47

Product Service

SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE
(B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) and GPS
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24

Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the FCC Testing of the Sharp SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) 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)	SHL22
Serial Number(s)	IMEI 004401114764422 IMEI 004401114764612 IMEI 004401114764513
Number of Samples Tested	3
Test Specification/Issue/Date	FCC CFR 47 Part 2 (2012) FCC CFR 47 Part 24 (2012)
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	9676 30 April 2013
Start of Test	23 May 2013
Finish of Test	10 June 2013
Name of Engineer(s)	M Russell G Lawler
Related Document(s)	ANSI C63.4: 2003

Product Service

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
	Pt 2	Pt 24			
PCS 1900					
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	2.1047(d)	-	Modulation Characteristics	-	Customer Declaration
2.5	2.1046	24.232	Maximum Peak Output Power - Conducted	Pass	
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	

Product Service

1.3 PRODUCT TECHNICAL DESCRIPTION

Please refer to the “04D_Model Description APYHRO00192.pdf” Model Description Form.

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) 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 standrards were made during testing.

1.7 MODIFICATION RECORD

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

Product Service

SECTION 2

TEST DETAILS

FCC Testing of the
Sharp SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE
(B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) and GPS
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24

Product Service

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

SHL22 S/N: IMEI 004401114764422 - Modification State 0

2.1.3 Date of Test

10 June 2013

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 modulation. An FSQ Signal 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	20.8°C
Relative Humidity	37.1%

Product Service

2.1.7 Test Results

4.0 V DC Supply

Under Temperature Variations

1880.00 MHz

Temperature Interval (ºC)	Mode	Deviation (ppm)
-30	GMSK	-0.019150
-20	GMSK	-0.016490
-10	GMSK	-0.014360
0	GMSK	-0.011700
+10	GMSK	-0.010110
+20	GMSK	-0.016490
+30	GMSK	-0.014362
+40	GMSK	-0.011702
+50	GMSK	-0.011702

Limit Clause

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

Under Voltage Variations

1880.00 MHz

DC Voltage (V)	Mode	Deviation (ppm)
4.0	GMSK	-0.01649
3.7	GMSK	-0.01064
4.0	GMSK	-0.01649

Limit Clause

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

Product Service

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

SHL22 S/N: IMEI 004401114764422 - Modification State 0

2.2.3 Date of Test

6 June 2013

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	27.3%

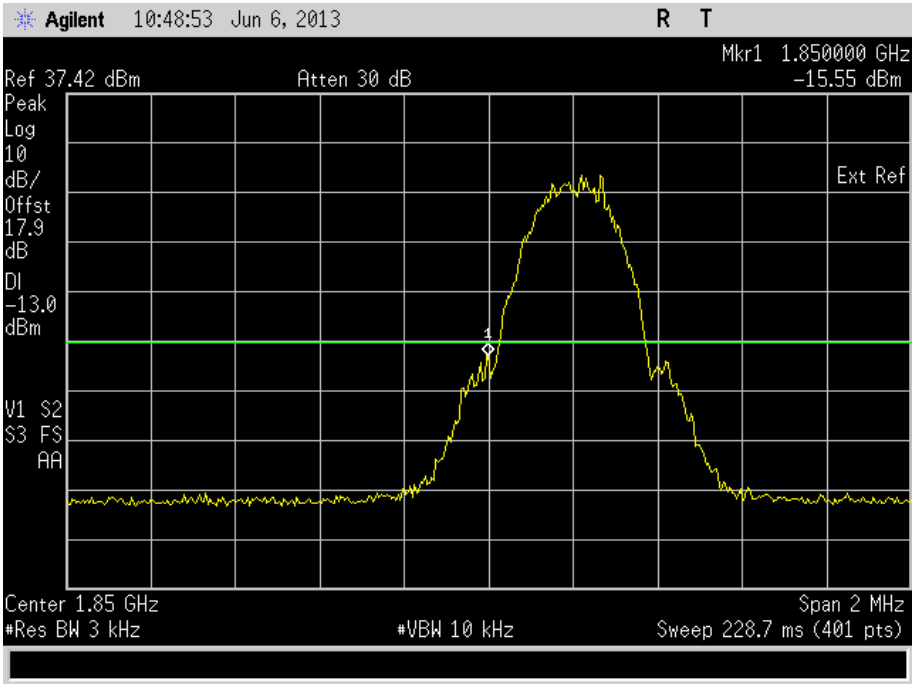
Product Service

2.2.7 Test Results

4.0 V DC Supply

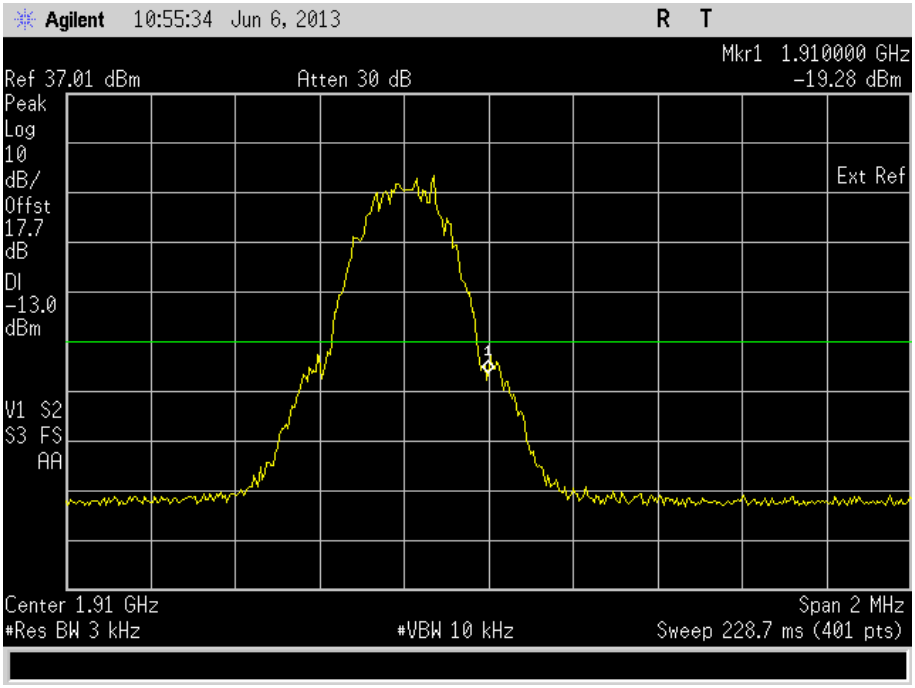
Frequency Block (MHz)	Mode	Lower Block Edge Test Channels/Frequencies	Upper Block Edge Test Channels/Frequencies
A :(1930.0 – 1945.0)	GMSK	Channel : 512 Frequency : 1850.2 MHz	N/A
B :(1975.0 – 1990.0)	GMSK	N/A	Channel : 810 Frequency : 1909.8 MHz

Frequency Block A



Product Service

Frequency Block B



Limit Clause

-13 dBm at block edge.

Product Service

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

SHL22 S/N: IMEI 004401114764612 - Modification State 0

2.3.3 Date of Test

26 May 2013

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

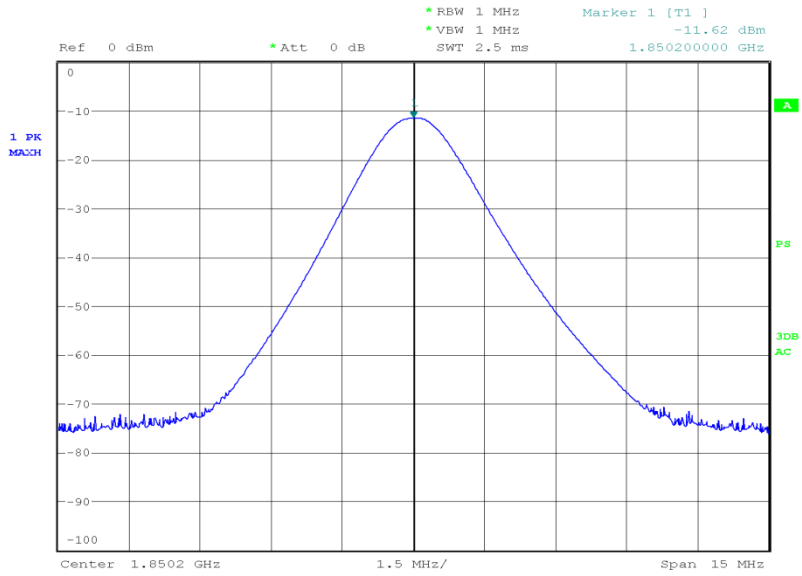
Ambient Temperature	17.9°C
Relative Humidity	35.0%

Product Service

2.3.7 Test Results

1850.20 MHz

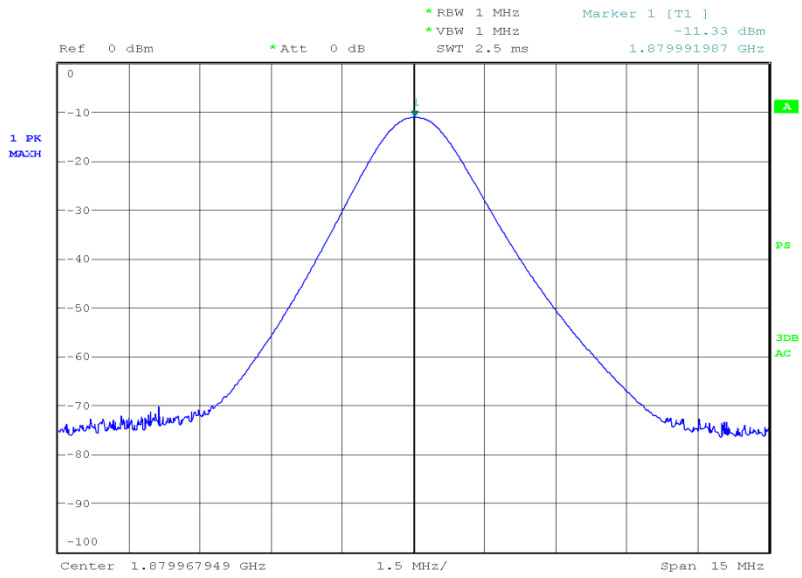
Result (dBm)	Result (W)
28.34	0.682



Date: 26.MAY.2013 14:28:20

1880.00 MHz

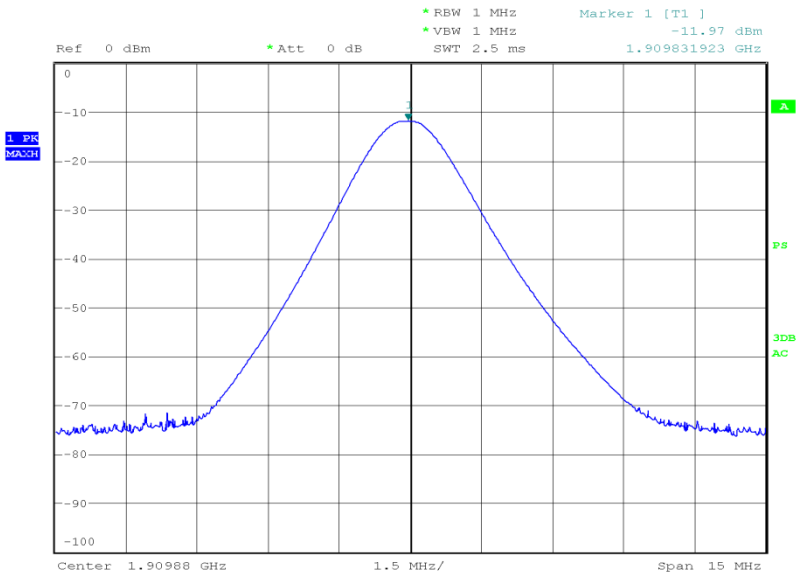
Result (dBm)	Result (W)
29.34	0.859



Date: 26.MAY.2013 14:46:30

1909.80 MHz

Result (dBm)	Result (W)
29.04	0.802



Date: 26.MAY.2013 15:07:07

Limit Clause

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

Product Service

2.4 MODULATION CHARACTERISTICS

2.4.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1047(d)

2.4.2 Equipment Under Test

SHL22

2.4.3 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

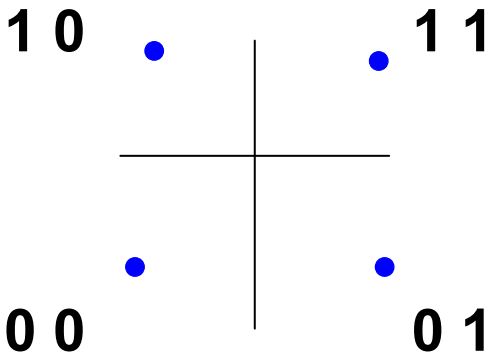
GMSK OVERVIEW

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)

However

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

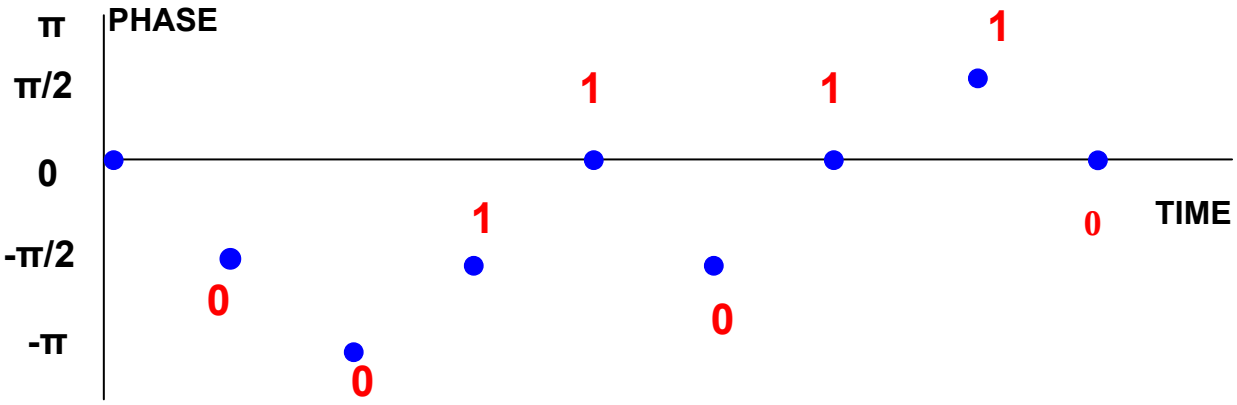
2. Modulate each stream with PSK (1 = 90° or π/2, 0 = -90° or - π/2 phase shift)

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

3. Combine (add) the two PSK signals:

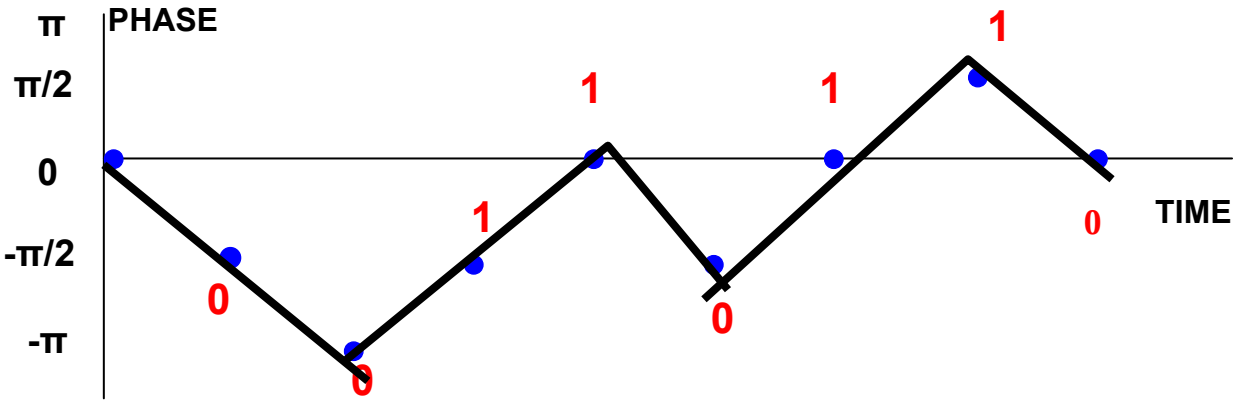
Combined Phase	-π/2	-π	-π/2	0	-π/2	0	π/2	0

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.

2.5 MAXIMUM PEAK OUTPUT POWER - CONDUCTED

2.5.1 Specification Reference

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

2.5.2 Equipment Under Test and Modification State

SHL22 S/N: IMEI 004401114764513 - Modification State 0

2.5.3 Date of Test

23 May 2013

2.5.4 Test Equipment Used

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

2.5.5 Test Procedure

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

The EUT was operating in PCS 1900 mode supporting GMSK modulation and was tested in this mode of operation.

2.5.6 Environmental Conditions

Ambient Temperature	23.4°C
Relative Humidity	27.3%

Product Service

2.5.7 Test Results

4.0 V DC Supply

1850.20 MHz

Mode	Result (dBm)	Result (W)
GMSK	31.03	1.268

1880.00 MHz

Mode	Result (dBm)	Result (W)
GMSK	31.08	1.283

1909.80 MHz

Mode	Result (dBm)	Result (W)
GMSK	31.07	1.28

Limit Clause

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

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

SHL22 S/N: IMEI 004401114764612 - Modification State 0

2.6.3 Date of Test

26 May 2013 & 10 June 2013

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

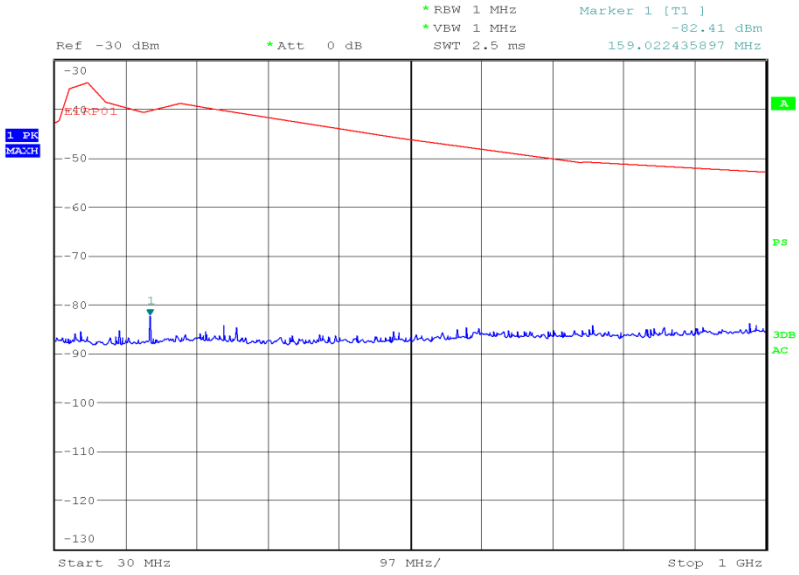
Ambient Temperature	17.9 - 20.9°C
Relative Humidity	35.0%

Product Service

2.6.7 Test Results

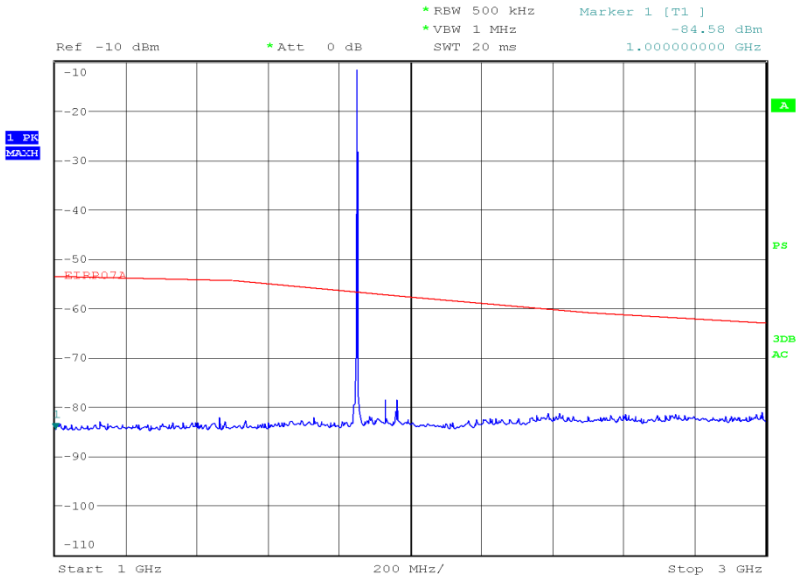
1850.20 MHz

30 MHz to 1 GHz



Date: 4.JUN.2013 18:02:58

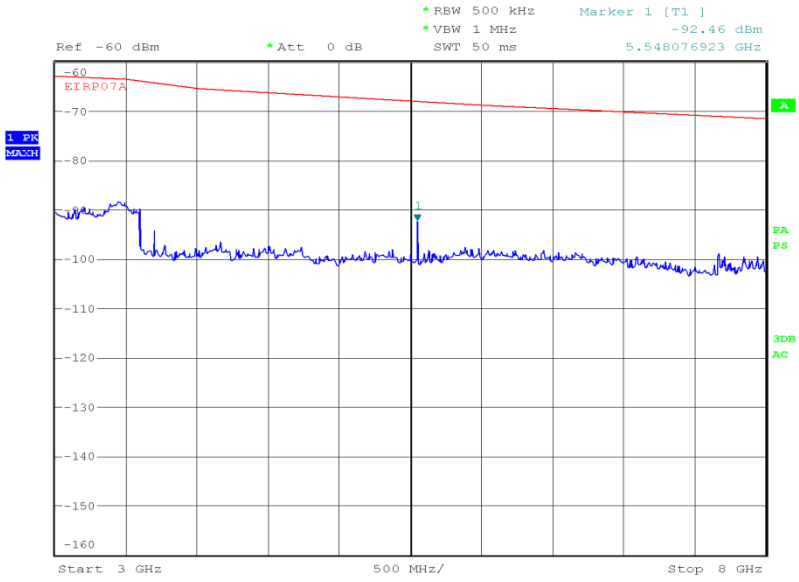
1 GHz to 3 GHz



Date: 26.MAY.2013 14:32:55

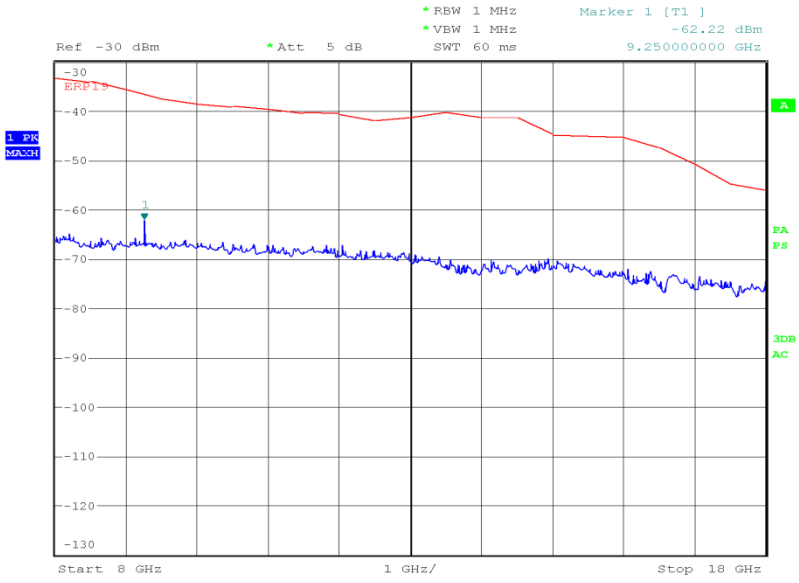
Product Service

3 GHz to 8 GHz



Date: 26.MAY.2013 14:37:37

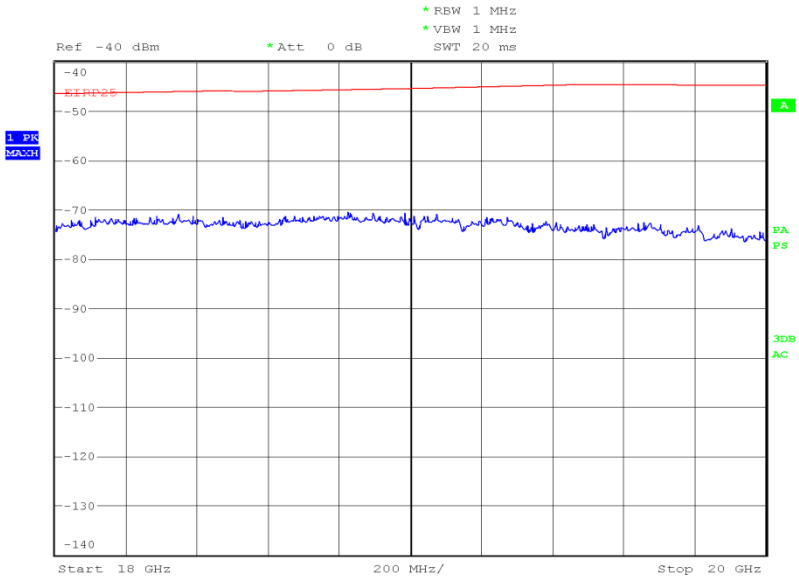
8 GHz to 18 GHz



Date: 4.JUN.2013 21:08:13

Product Service

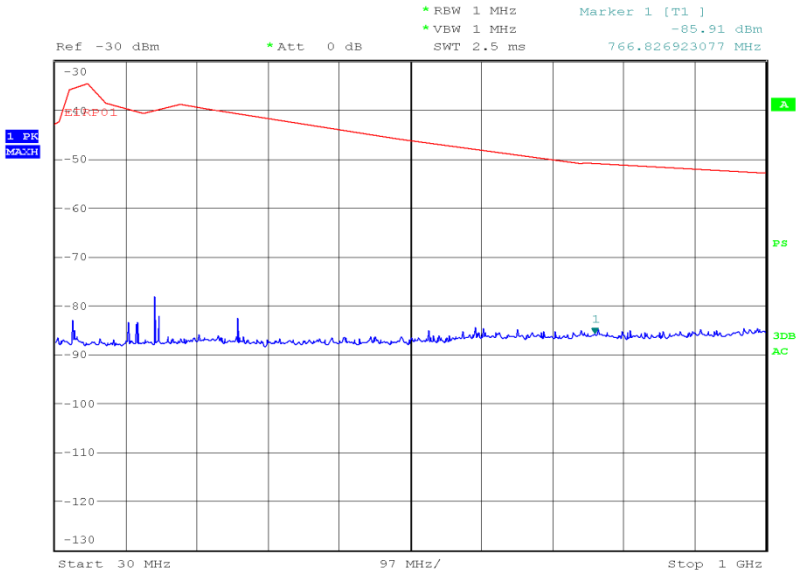
18 GHz to 20 GHz



Date: 10.JUN.2013 22:58:08

1880.00 MHz

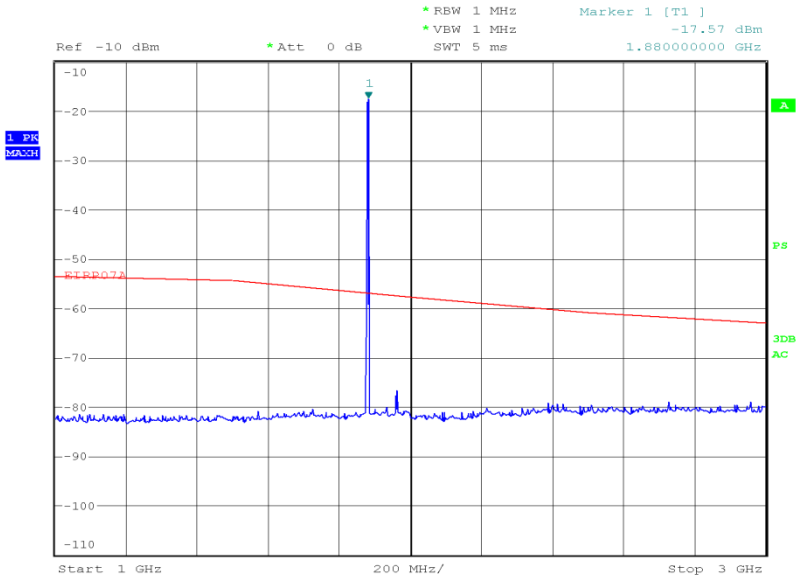
30 MHz to 1 GHz



Date: 4.JUN.2013 18:00:53

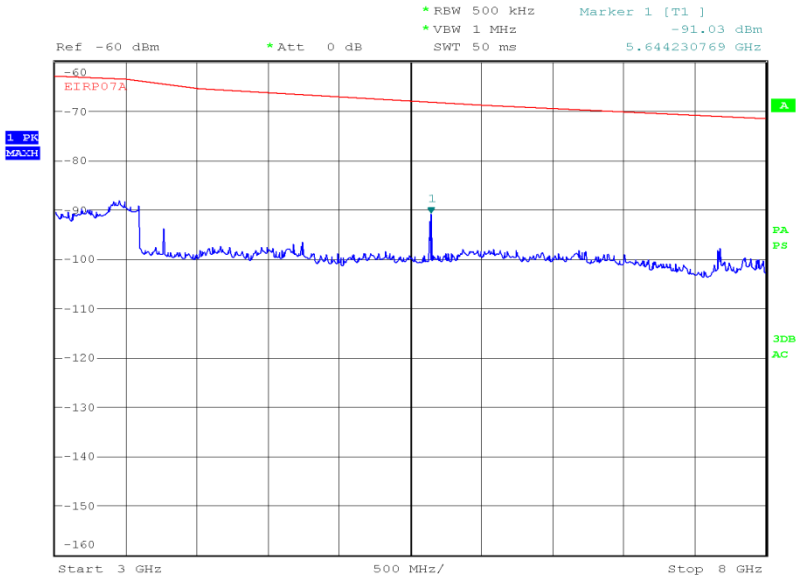
Product Service

1 GHz to 3 GHz



Date: 26.MAY.2013 14:42:23

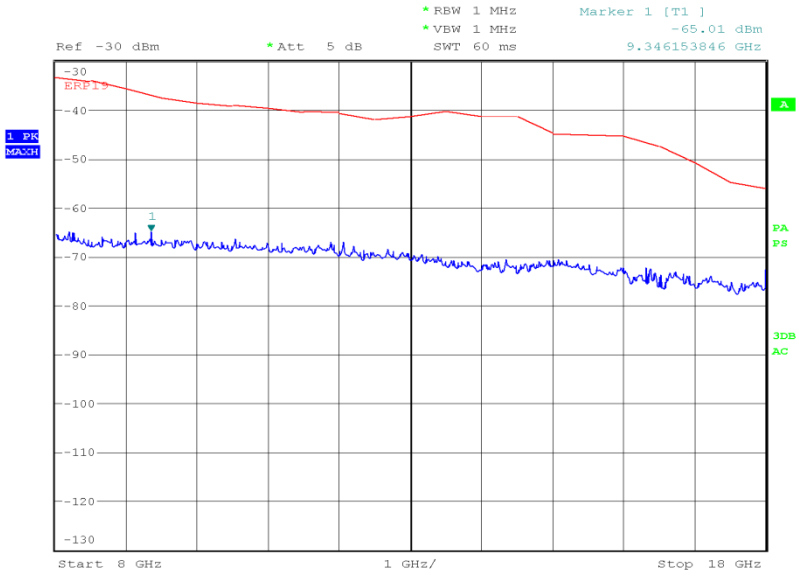
3 GHz to 8 GHz



Date: 26.MAY.2013 14:39:53

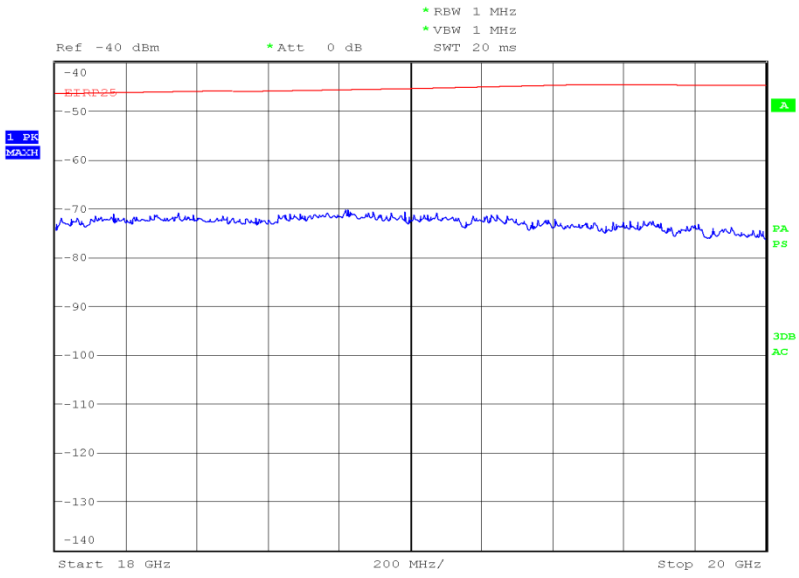
Product Service

8 GHz to 18 GHz



Date: 4.JUN.2013 21:10:17

18 GHz to 20 GHz

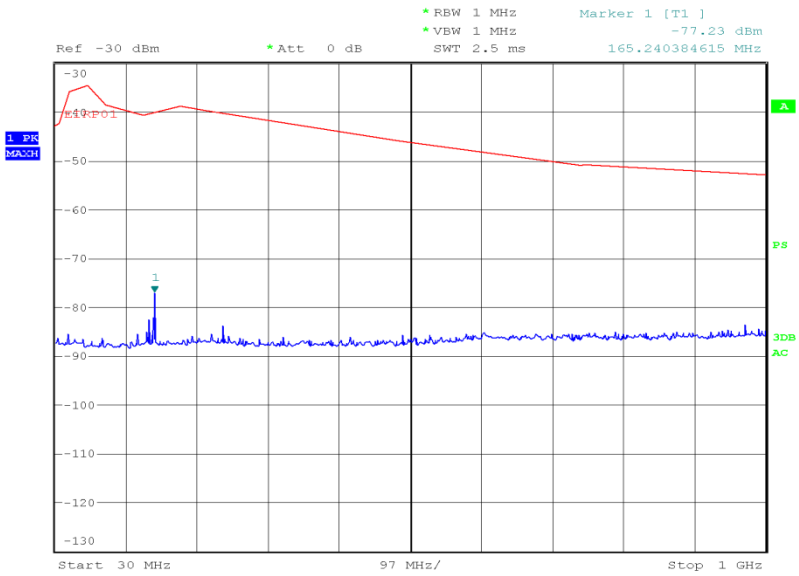


Date: 10.JUN.2013 22:59:49

Product Service

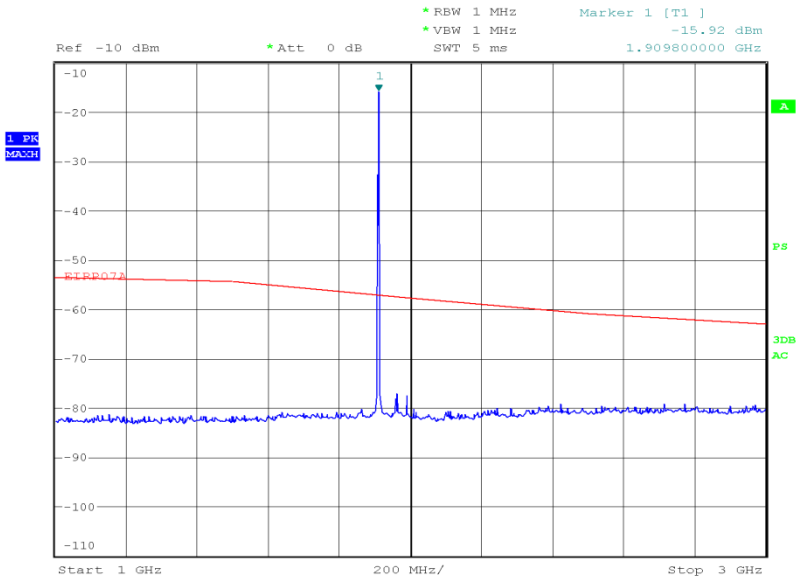
1909.80 MHz

30 MHz to 1 GHz



Date: 4.JUN.2013 18:05:00

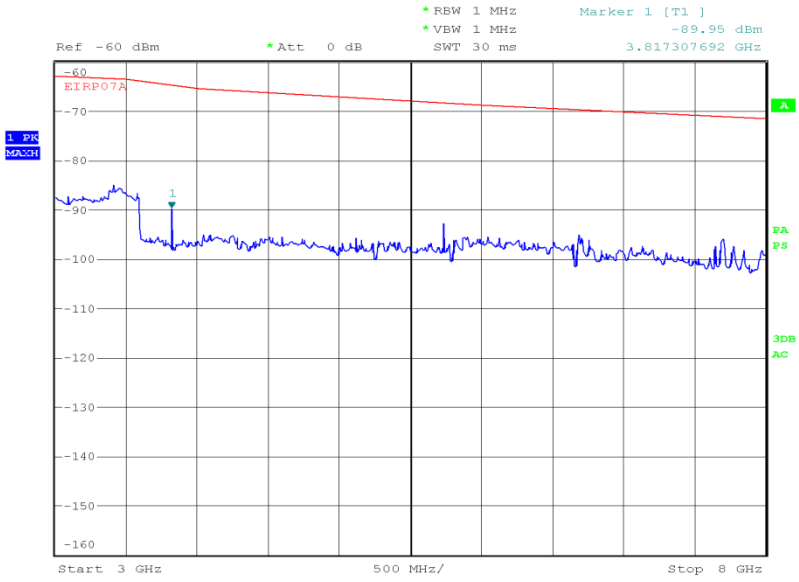
1 GHz to 3 GHz



Date: 26.MAY.2013 14:54:55

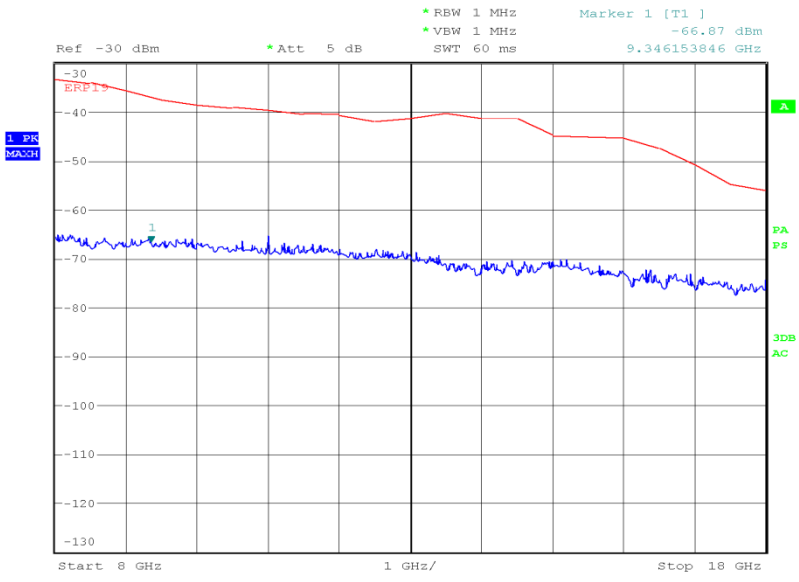
Product Service

3 GHz to 8 GHz



Date: 26.MAY.2013 14:57:26

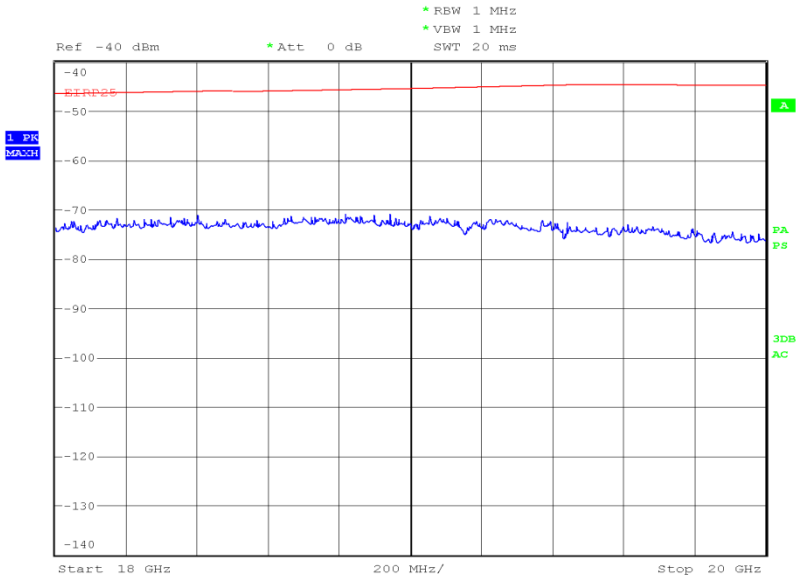
8 GHz to 18 GHz



Date: 4.JUN.2013 21:13:48

Product Service

18 GHz to 20 GHz



Date: 10.JUN.2013 23:01:47

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

SHL22 S/N: IMEI 004401114764422 - Modification State 0

2.7.3 Date of Test

6 June 2013

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	22.2°C
Relative Humidity	45.9%

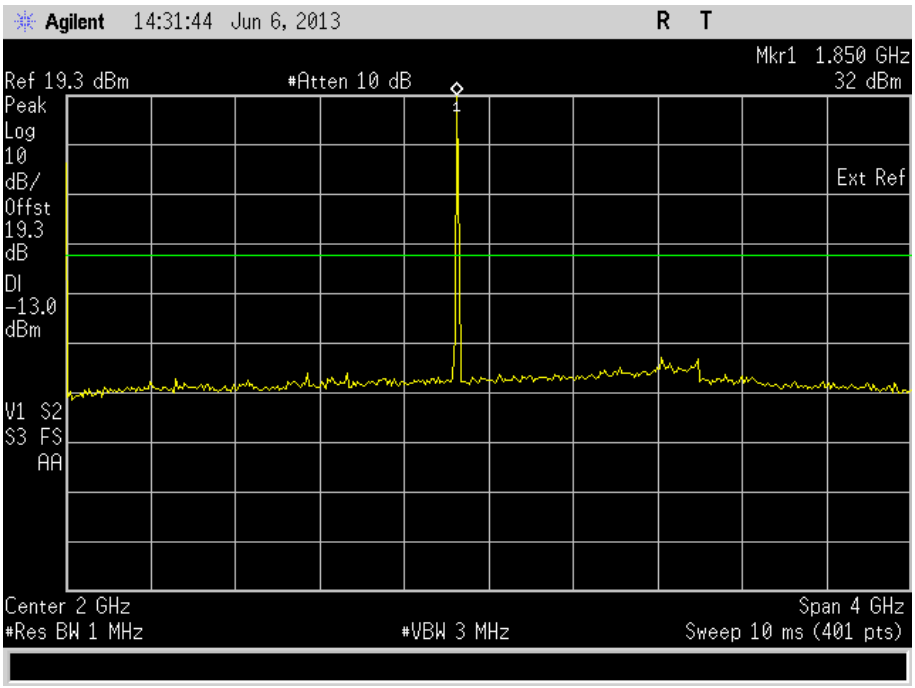
Product Service

2.7.7 Test Results

4.0 V DC Supply

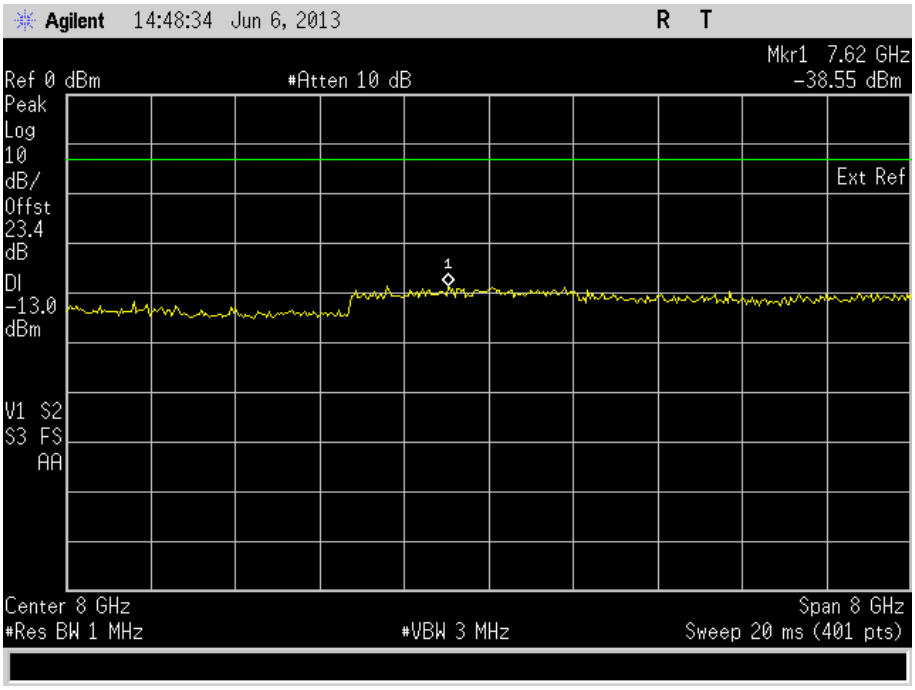
1850.20 MHz

9kHz to 4 GHz

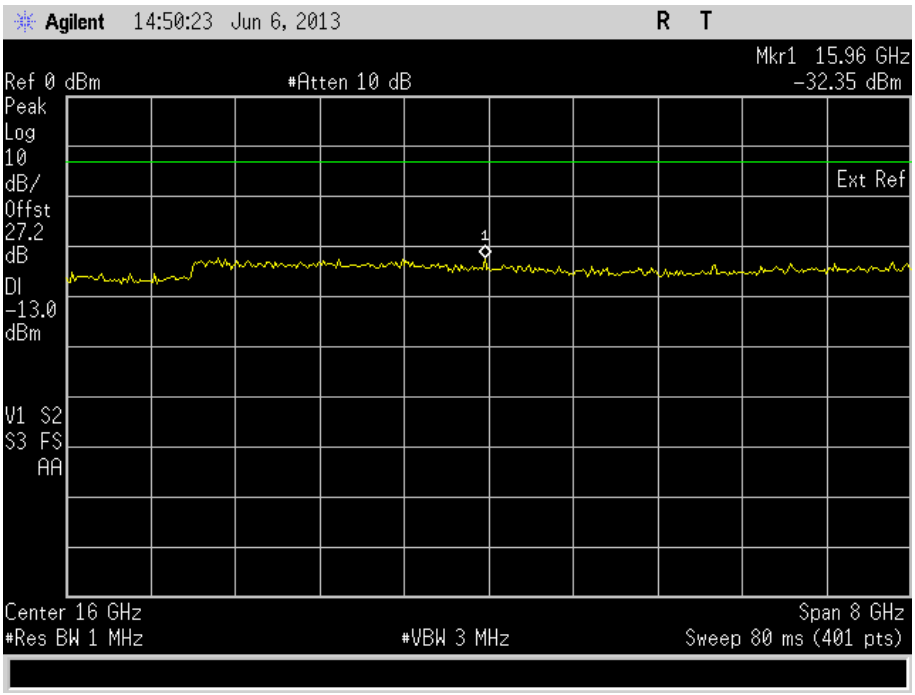


Product Service

4 GHz to 12 GHz



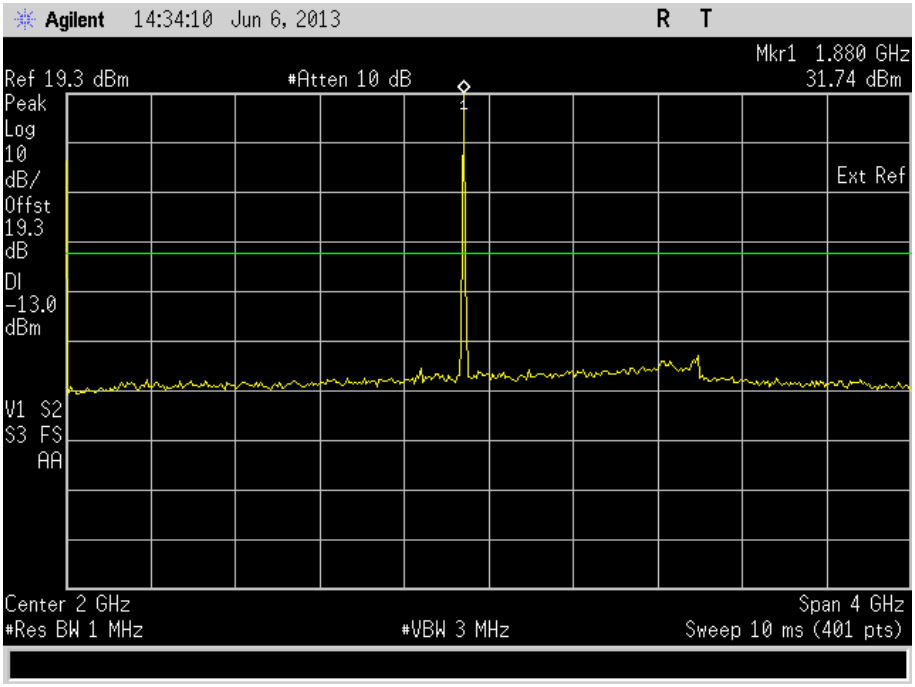
12 GHz to 20 GHz



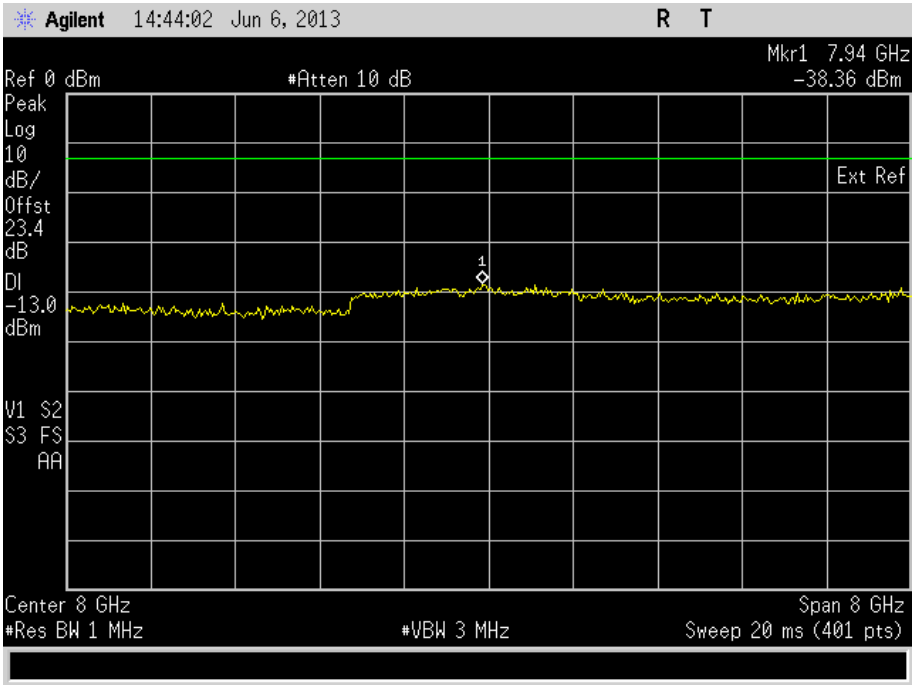
Product Service

1880.00 MHz

9kHz to 4 GHz

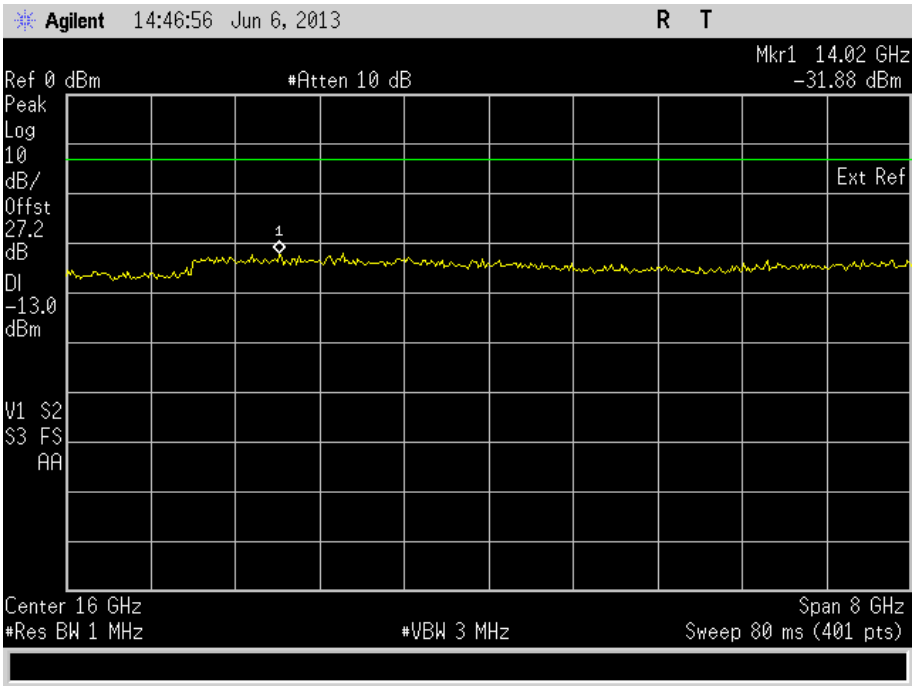


4 GHz to 12 GHz



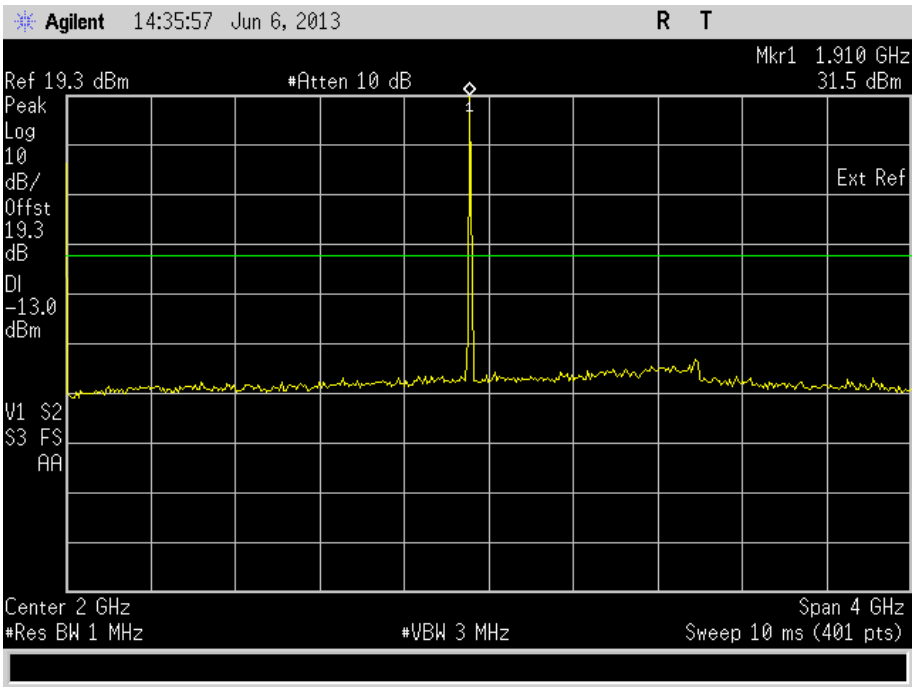
Product Service

12 GHz to 20 GHz



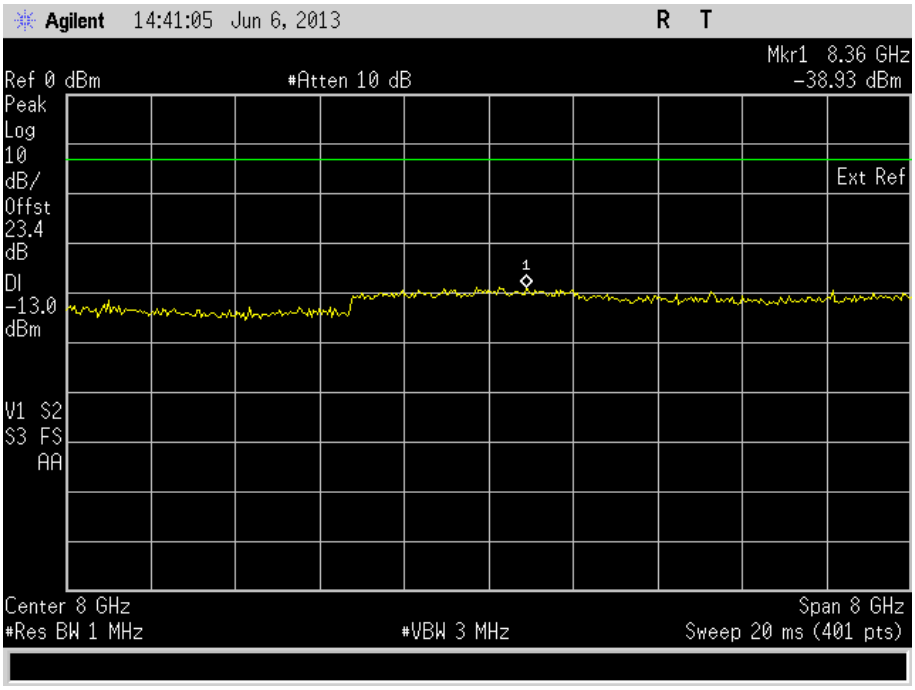
1909.80 MHz

9kHz to 4 GHz

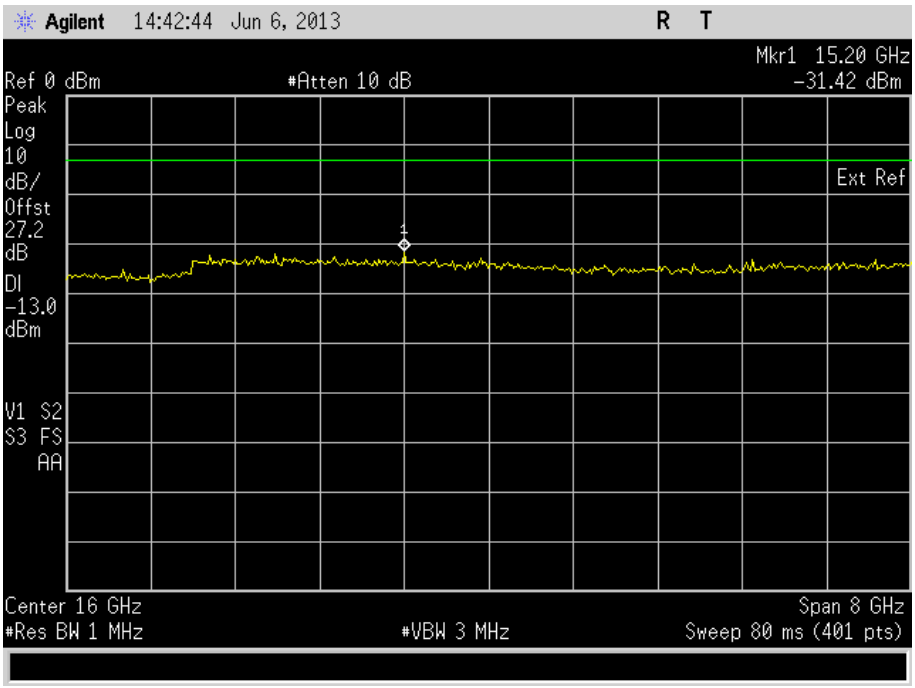


Product Service

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

SHL22 S/N: IMEI 004401114764422 - Modification State 0

2.8.3 Date of Test

6 June 2013

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 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	27.3%

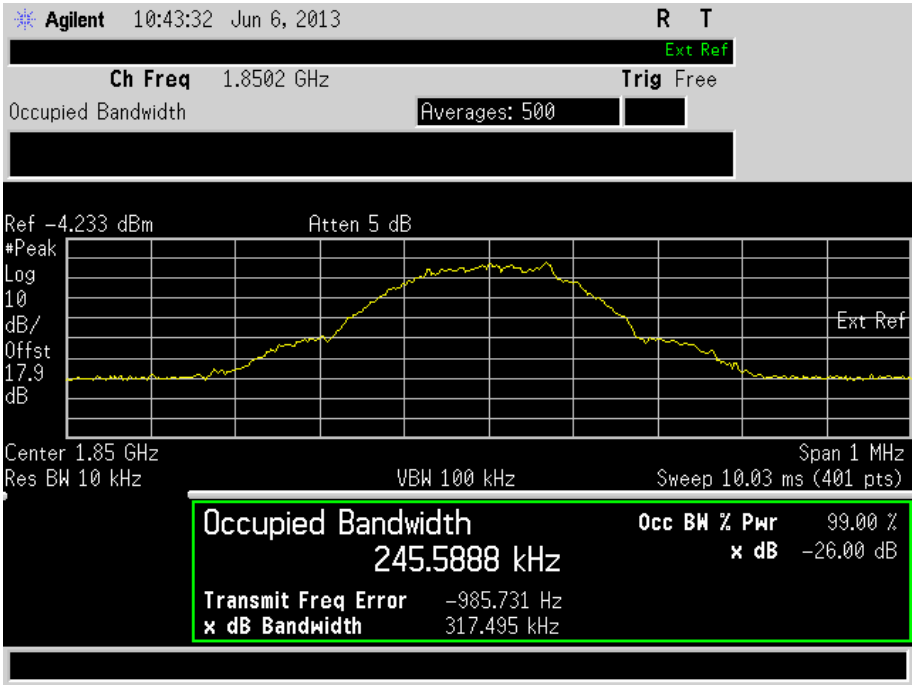
Product Service

2.8.7 Test Results

4.0 V DC Supply

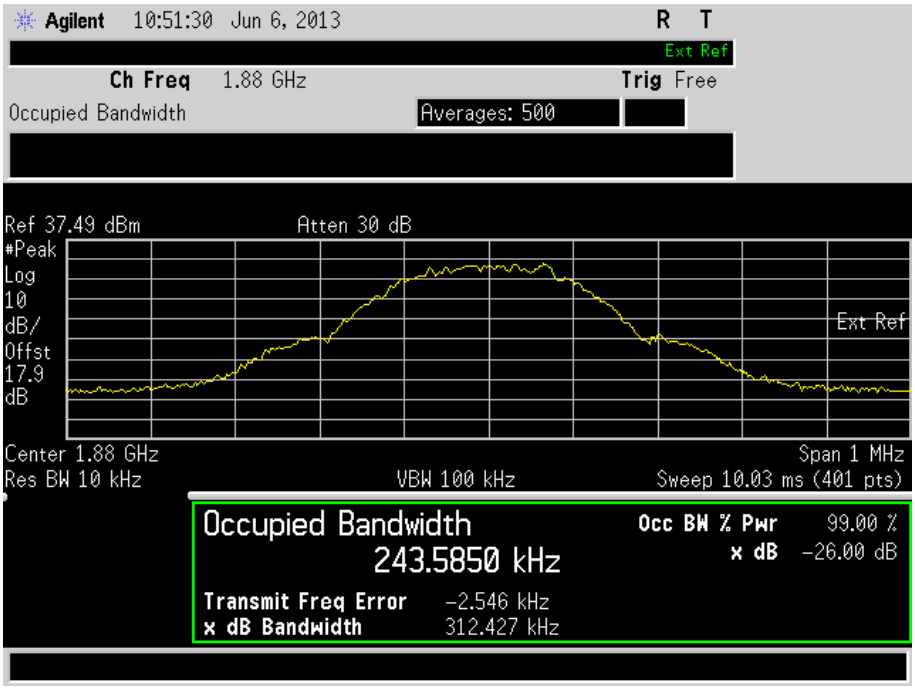
1850.20 MHz

Mode	Occupied Bandwidth (kHz)
GMSK	245.5888



1880.00 MHz

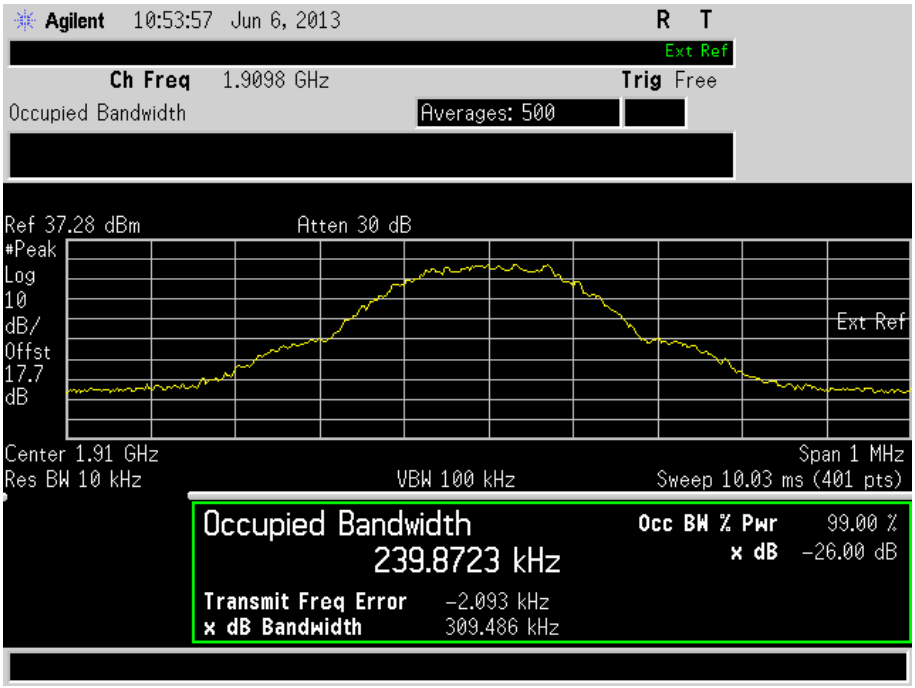
Mode	Occupied Bandwidth (kHz)
GMSK	243.585



Product Service

1909.80 MHz

Mode	Occupied Bandwidth (kHz)
GMSK	239.8722



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					
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Multimeter	White Gold	WG022	190	12	30-Oct-2013
RF Coupler	TUV SUD Product Service	TÜV	415	-	TU
Communications Tester	Rohde & Schwarz	CMU 200	442	12	1-Nov-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	30-Nov-2013
Attenuator (20dB, 2W)	Pasternack	PE 7004-20	2943	12	27-Mar-2014
Thermocouple Thermometer	Fluke	51	3172	12	30-Jul-2013
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Section 2.2- Spurious Emissions at Band Edge					
Multimeter	White Gold	WG022	190	12	30-Oct-2013
Communications Tester	Rohde & Schwarz	CMU 200	442	12	1-Nov-2013
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jul-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	11-Dec-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
Combiner/Splitter	Weinschel	1506A	3877	12	19-Mar-2014
Section 2.3 - Effective Isotropic Radiated Power					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	3-Apr-2014
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	9-Nov-2013
Communications Tester	Rohde & Schwarz	CMU 200	442	12	1-Nov-2013
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	1002	12	7-Aug-2013
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Log Periodic)	Schaffner	UPA6108	3108	12	5-Apr-2014
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	11-Oct-2013
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
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 2.5 - Maximum Peak Output Power - Conducted					
Multimeter	White Gold	WG022	190	12	30-Oct-2013
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	12	24-Jul-2013
Attenuator: 6dB/10W	Trilithic	HFP-50N	476	12	24-Jul-2013
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jul-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Power Supply	Hewlett Packard	6104A	1948	-	TU
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Multimeter	Iso-tech	IDM101	2419	12	3-Oct-2013
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	11-Dec-2013
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	23-Jun-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
Combiner/Splitter	Weinschel	1506A	3877	12	19-Mar-2014
Combiner/Splitter	Weinschel	1506A	3878	12	19-Mar-2014
P-Series Power Meter	Agilent	N1911A	3980	12	17-Sep-2013
P-Series Power Meter	Agilent	N1911A	3981	12	17-Sep-2013
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3982	12	17-Sep-2013
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3983	12	17-Sep-2013
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4100	12	25-Oct-2013
1 Metre K Type Cable	Rhophase	KPS-1501A-1000-KPS	4105	12	25-Oct-2013
Section 2.6 - Emission for Broadband PCS Equipment					
Radiocommunications Tester	Rohde & Schwarz	CMU 200	39	12	21-Dec-2013
Antenna (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	13-Sep-2013
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	9-Nov-2013
Load (50ohm, 30W)	JFW	50T-054	284	12	13-Jun-2013
Antenna (Bilog)	Schaffner	CBL6143	287	24	18-Jan-2014
Antenna (Active Loop, 9kHz-30MHz)	Rohde & Schwarz	HFH2-Z2	333	24	30-Oct-2014
Communications Tester	Rohde & Schwarz	CMU 200	442	12	1-Nov-2013
Filter (High Pass)	Lorch	SHP7-7000-SR	566	12	20-Feb-2014
Pre-Amplifier	Phase One	PS04-0086	1533	12	27-Sep-2013
Pre-Amplifier	Phase One	PSO4-0087	1534	12	28-Sep-2013
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Filter	Daden Anthony Ass	MH-1500-7SS	2778	-	TU
Amplifier (1 - 8GHz)	Phase One	PS06-0060	3175	12	10-Jul-2013
Amplifier (8 - 18GHz)	Phase One	PS06-0061	3176	12	10-Jul-2013
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	11-Oct-2013
3 GHz High Pass Filter	K&L Microwave	11SH10-3000/X18000-O/O	3552	12	1-Feb-2014
'2.92mm' - '2.92mm' RF Cable (2m)	Rhophase	KPS-1503-2000-KPS	3694	12	25-Oct-2013
'2.92mm' - '2.92mm' RF Cable (2m)	Rhophase	KPS-1503-2000-KPS	3695	12	15-Oct-2013
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
1 metre, SMA to SMA	Suhner	Sucoflex armoured cable	4048	-	O/P Mon

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.7- Conducted Spurious Emissions					
Multimeter	White Gold	WG022	190	12	30-Oct-2013
Communications Tester	Rohde & Schwarz	CMU 200	442	12	1-Nov-2013
Attenuator: 6dB/10W	Trilithic	HFP-50N	476	12	24-Jul-2013
Filter (High Pass)	Lorch	SHP7-7000-SR	566	12	20-Feb-2014
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jul-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Power Supply	Hewlett Packard	6104A	1948	-	TU
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Multimeter	Iso-tech	IDM101	2419	12	3-Oct-2013
High Pass Filter (4GHz)	RLC Electronics	F-100-4000-5-R	2773	12	1-Feb-2014
Test Receiver	Rohde & Schwarz	ESIB40	2941	12	23-Oct-2013
Attenuator (20dB, 2W)	Pasternack	PE 7004-20	2943	12	27-Mar-2014
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	11-Dec-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
Combiner/Splitter	Weinschel	1506A	3877	12	19-Mar-2014
Data Logger	Yokogawa	MV1024	3948	12	7-Jun-2013
Section 2.8 - Occupied Bandwidth					
Multimeter	White Gold	WG022	190	12	30-Oct-2013
Communications Tester	Rohde & Schwarz	CMU 200	442	12	1-Nov-2013
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	12	24-Jul-2013
Attenuator: 6dB/10W	Trilithic	HFP-50N	476	12	24-Jul-2013
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jul-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Power Supply	Hewlett Packard	6104A	1948	-	TU
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Multimeter	Iso-tech	IDM101	2419	12	3-Oct-2013
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	11-Dec-2013
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	23-Jun-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
Combiner/Splitter	Weinschel	1506A	3877	12	19-Mar-2014
Combiner/Splitter	Weinschel	1506A	3878	12	19-Mar-2014
P-Series Power Meter	Agilent	N1911A	3980	12	17-Sep-2013
P-Series Power Meter	Agilent	N1911A	3981	12	17-Sep-2013
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3982	12	17-Sep-2013
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3983	12	17-Sep-2013
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4100	12	25-Oct-2013
1 Metre K Type Cable	Rhophase	KPS-1501A-1000-KPS	4105	12	25-Oct-2013

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

3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	MU
Modulation Characteristics	-
Maximum Peak Output Power - Conducted	± 0.70 dB
Emission for Broadband PCS Equipment	± 3.08 dB
Conducted Spurious Emissions	± 3.454 dB
Spurious Emissions at Band Edge	± 2.20 dB
Occupied Bandwidth	± 10.14 kHz
Effective Isotropic Radiated Power	± 3.08 dB
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).