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Report On

FCC Testing of the Sharp Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B26) multi mode cellular phone with Bluetooth, WLAN, SRD (FeliCa) and GPS
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24 (PCS 1900)

COMMERCIAL-IN-CONFIDENCE
FCC ID: APYHRO00215

Document 75928270 Report 12 Issue 1 January 2015

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REPORT ON

FCC Testing of the Sharp Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B26) multi mode cellular phone with Bluetooth, WLAN, SRD (FeliCa) and GPS
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24 (PCS 1900)

Document 75928270 Report 12 Issue 1

January 2015

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DATED 15 January 2015

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);

G Lawler M Russell

Product Service

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SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp Dual-band CDMA (BC0, BC6) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE
(B1, B11, B26) multi mode cellular phone with Bluetooth, WLAN, SRD (FeliCa) and GPS
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24 (PCS 1900)

1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC Testing of the Sharp Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B26) multi mode cellular phone with Bluetooth, WLAN, SRD (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
Serial Number(s)	IMEI 004401115346674 IMEI 004401115348563
Number of Samples Tested	2
Test Specification/Issue/Date	FCC CFR 47 Part 2 (2013) FCC CFR 47 Part 24 (2013)
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	10330 20 October 2014
Start of Test	5 December 2014
Finish of Test	21 December 2014
Name of Engineer(s)	G Lawler M Russell
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	24.235	Frequency Stability	Pass	
2.2	2.1051	24.229 and 24.238	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 Limitations for Broadband PCS Equipment	Pass	
2.7	2.1051	24.238(a)	Conducted Spurious Emissions	Pass	
2.8	2.1049(h)	24.238(b)	Emission Bandwidth	Pass	

1.3 PRODUCT TECHNICAL DESCRIPTION

Please refer to the Model Description Form, reference FCC ID: APYHRO00215.

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B26) multi mode cellular phone with Bluetooth, WLAN, SRD (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 Measurement Facility Registration Number
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard 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 Dual-band CDMA (BC0, BC6) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE
(B1, B11, B26) multi mode cellular phone with Bluetooth, WLAN, SRD (FeliCa) and GPS
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24 (PCS 1900)

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 24.235

2.1.2 Equipment Under Test and Modification State

S/N: IMEI 004401115346674 - Modification State 0

2.1.3 Date of Test

19 December 2014

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 test was applied in accordance with the test method requirements of FCC CFR 47 Part 24.135(a) and FCC CFR 47 Part 2.1055.

The EUT was configured in a GSM circuit switched voice call using GMSK modulation at maximum output power on the middle channel using a communications test set. The communications test set was connected to an external 10 MHz rubidium frequency standard to increase accuracy of the measurement. The Tx measurement function of the communications tester was then used and the maximum frequency error was then recorded.

2.1.6 Environmental Conditions

Ambient Temperature	22.4°C
Relative Humidity	48.2%

Product Service

2.1.7 Test Results

4.0 V DC Supply

Under Temperature Variations

1880.0 MHz

Temperature Interval (ºC)	Mode	Deviation (ppm)
-30	GMSK	0.034
-20	GMSK	0.035
-10	GMSK	0.033
0	GMSK	0.033
+10	GMSK	0.035
+20	GMSK	0.035
+30	GMSK	0.035
+40	GMSK	0.033
+50	GMSK	0.034

Under Voltage Variations

1880.0 MHz

DC Voltage (V)	Mode	Deviation (ppm)
4.0	GMSK	0.035
3.7	GMSK	0.033
N/A	GMSK	N/A

Limit Clause

The frequecy stability shall be sufficient to ensure that the fundamental emission stays within the authorised frequency block.

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 and 24.238

2.2.2 Equipment Under Test and Modification State

S/N: IMEI 004401115346674 - Modification State 0

2.2.3 Date of Test

16 December 2014

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

Measurements were performed in accordance with KDB 971168 v02r02 clause 6.

The EUT was connected to a spectrum analyser via a cable, combiner and attenuator. The other port of the combiner was connected to a communications test set which was configured with a circuit switched voice call at maximum output power. The path loss was calibrated using a vector network analyser and was entered as a reference level offset on the spectrum analyser. The frame clock output from the communications test set was used to trigger the spectrum analyser and using a gated trigger with RMS detector an average measurement was performed. The RBW of the spectrum analyser was configured at not less than 1% of the emission bandwidth and it was verified that all emissions in the 1 MHz immediately adjacent to the authorized bandwidth were below 43 + 10 Log (P).

2.2.6 Environmental Conditions

Ambient Temperature	22.3°C
Relative Humidity	29.8%

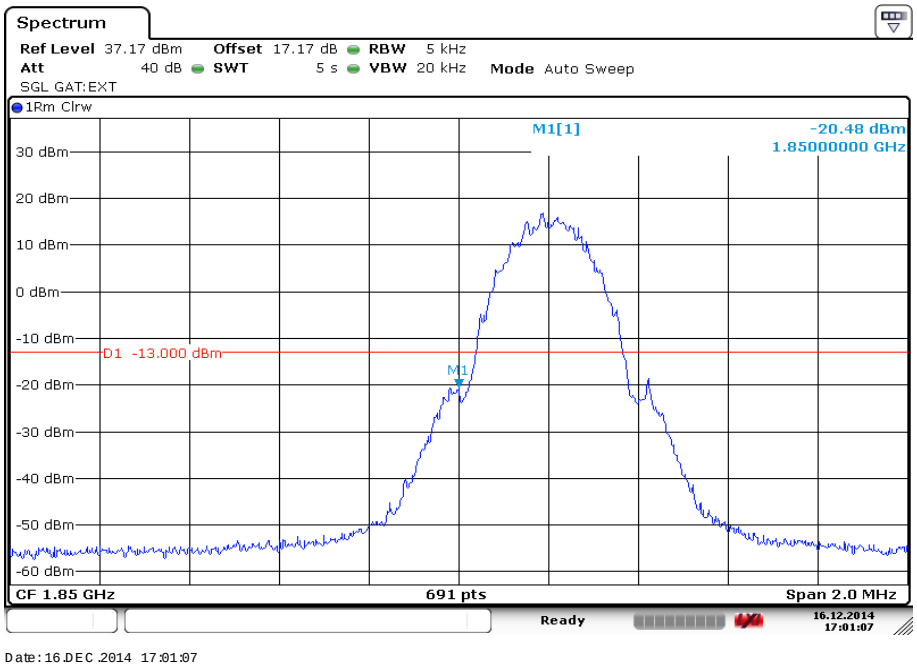
Product Service

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 :(1850 - 1865)	GMSK	Channel : 512 Frequency : 1850.2 MHz	N/A
C :(1895 - 1910)	GMSK	N/A	Channel : 810 Frequency : 1909.8 MHz

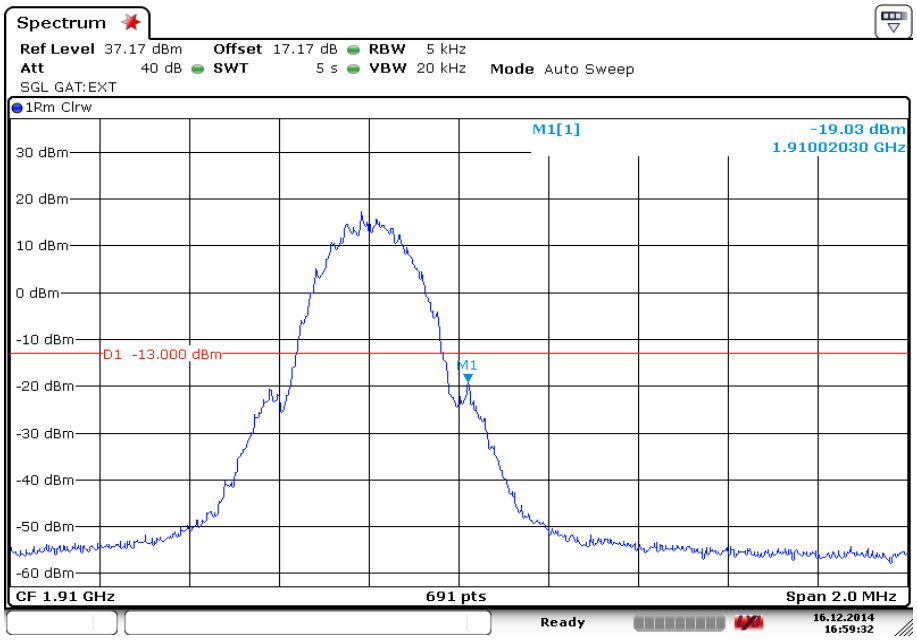
Frequency Block A



Date: 16.DEC.2014 17:01:07

Product Service

Frequency Block C



Date: 16.DEC.2014 16:59:32

Limit Clause

Out of band emissions: The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Product Service

2.3 EFFECTIVE ISOTROPIC RADIATED POWER

2.3.1 Specification Reference

FCC CFR 47 Part 2 and FCC CFR 47 Part 24, Clause 24.232(c)

2.3.2 Equipment Under Test and Modification State

S/N: IMEI 004401115348563 - Modification State 0

2.3.3 Date of Test

21 December 2014

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

The test was applied in accordance with the requirements of FCC CFR 47 Part 24.232(c) in conjunction with the radiated measurement and substitution test methods described in FCC 971168 D01 Power Meas License Digital Systems v02r01. The ERP measurements were determined using the methods described in clause 6 of FCC 412172 D01 Determining ERP and EIRP v01.

The Effective Isotropic Radiated Power (EIRP) was determined by measuring the parameters utilised by the following formula: ERP = PSigGen + GT - LC

Where PSigGen is the power setting of the signal generator that produces the same received power reading as the EUT, GT is the gain of the substitute antenna in dBd and LC is the signal loss in the cable connecting the signal generator to the substitute antenna in dB. These parameters were measured using the following procedure.

The EUT was setup on a turntable with a separation distance of 3 m from the measuring antenna. A spectrum analyser was used to measure the peak amplitude of the fundamental emission. The spectrum analyser utilised a peak detector with resolution and video bandwidths exceeding the emission bandwidth, in conjunction with the trace set to max-hold. The EUT azimuth, measuring antenna height and polarisations were adjusted until the fundamental emission amplitude was maximised on the spectrum analyser. The peak fundamental emission amplitude was determined using a peak marker function on the maximised trace.

The EUT was substituted with a calibrated transmitting antenna connected to a calibrated signal generator using an RF cable. The signal generator was configured to transmit CW at the frequency of the previously measured fundamental emission. The signal generator output level was adjusted until the spectrum analyser measured a signal level equal to the previous peak fundamental emission amplitude; yielding a value for PSigGen.

The substitution antenna gain (GT) and the RF cable loss (LC) for the emission frequency were applied to the value of PSigGen using the previously defined ERP formula. The result of which determined the peak ERP of the fundamental emission.

Finally, a wideband power meter and sensor was used to determine a correction factor which was applied to the result above to obtain the final result.

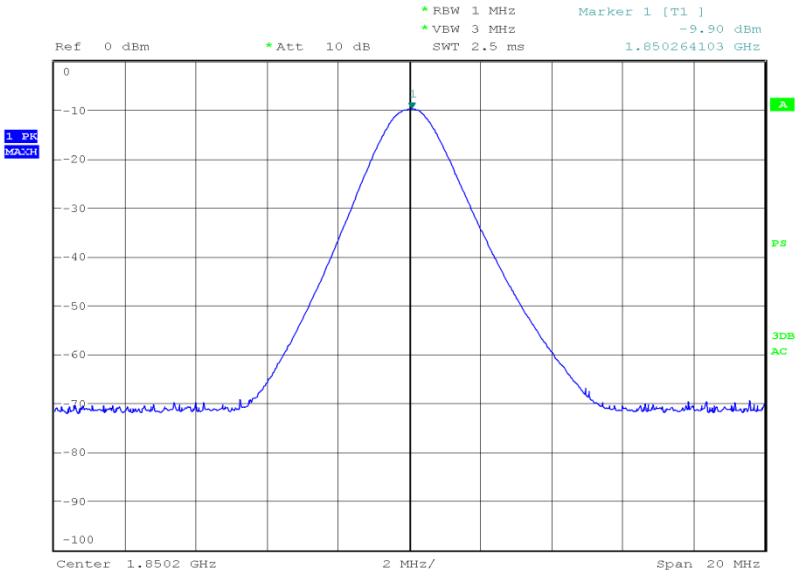
2.3.6 Environmental Conditions

Ambient Temperature	20.8°C
Relative Humidity	33.0%

2.3.7 Test Results

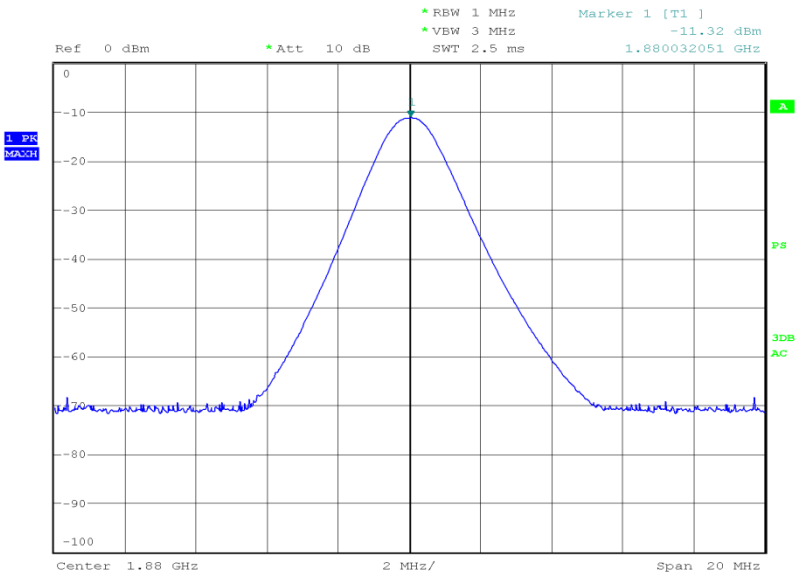
1850.2 MHz

Result (dBm)	Result (W)
30.30	1.072



1880.0 MHz

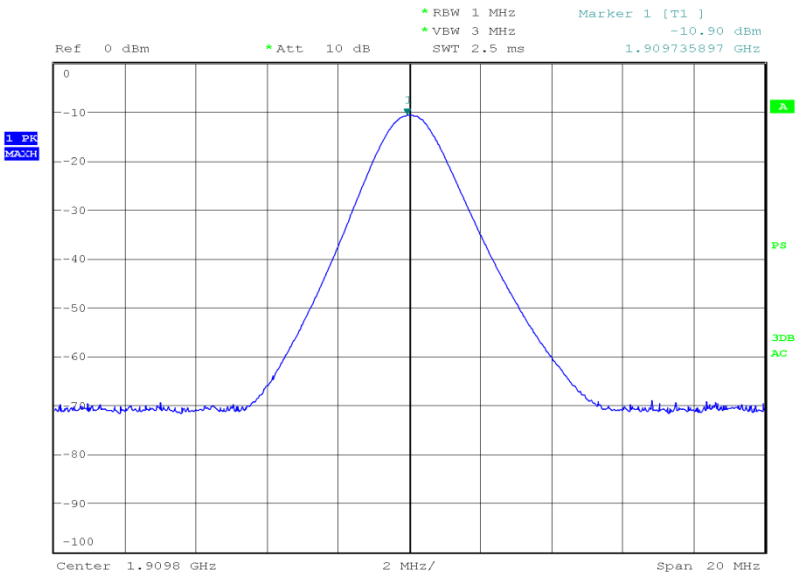
Result (dBm)	Result (W)
29.33	0.857



Date: 21.DEC.2014 10:27:24

1909.8 MHz

Result (dBm)	Result (W)
29.93	0.984



Date: 21.DEC.2014 10:37:39

Limit Clause

Mobile and portable stations are limited to 2 Watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

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

S/N: IMEI 004401115346674 - Modification State 0

2.4.3 Date of Test

5 December 2014

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

This test was performed with the test method requirements as stated in KDB 971168 D01 v02r01 clause 5.1.2.

The EUT was connected to a broadband peak power meter via a cable, combiner and attenuator. The other port of the combiner was connected to a communications test set which was configured with a circuit switched voice call at maximum output power. The path loss was calibrated using a vector network analyser and was entered as an offset on the power meter. The peak power was then recorded as shown in the table below.

2.4.6 Environmental Conditions

Ambient Temperature	22.5°C
Relative Humidity	30.1%

Product Service

2.4.7 Test Results

4.0 V DC Supply

1850.2 MHz

Mode	Result (dBm)	Result (W)
GMSK	29.24	0.839

1880.0 MHz

Mode	Result (dBm)	Result (W)
GMSK	29.10	0.813

1909.8 MHz

Mode	Result (dBm)	Result (W)
GMSK	29.17	0.826

Limit Clause

Mobile and portable stations are limited to 2 Watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

2.5 MODULATION CHARACTERISTICS

2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1047(d)

2.5.2 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

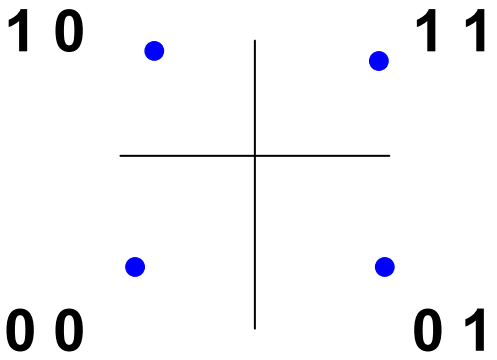
GMSK OVERVIEW

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

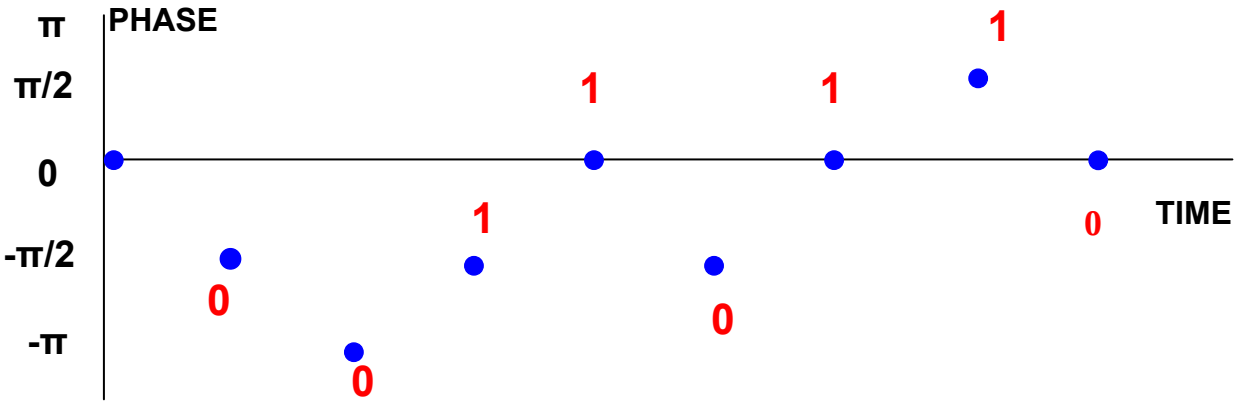
2. Modulate each stream with PSK (1 = 90° or π/2, 0 = -90° or - π/2 phase shift)

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:

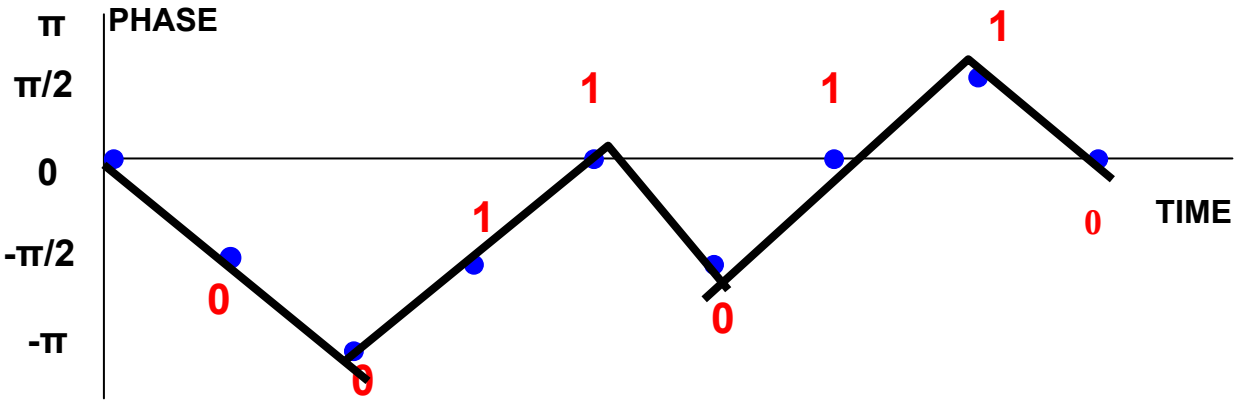
Combined Phase	-π/2	-π	-π/2	0	-π/2	0	π/2	0

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.

2.6 EMISSION LIMITATIONS 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

S/N: IMEI 004401115348563 - Modification State 0

2.6.3 Date of Test

21 December 2014

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 configured in a GSM call using GMSK modulation at maximum output power on the bottom, middle and top channels using a communications test set.

For any emissions found the Effective Radiated Power (ERP) was determined by measuring the parameters utilised by the following formula: ERP = PSigGen + GT - LC

Where PSigGen is the power setting of the signal generator that produces the same received power reading as the EUT, GT is the gain of the substitute antenna in dBd and LC is the signal loss in the cable connecting the signal generator to the substitute antenna in dB. These parameters were measured using the following procedure.

The EUT was setup on a turntable with a separation distance of 3 m from the measuring antenna. A spectrum analyser was used to measure the peak amplitude of the fundamental emission. The spectrum analyser utilised a peak detector with resolution and video bandwidths exceeding the emission bandwidth, in conjunction with the trace set to max-hold. The EUT azimuth, measuring antenna height and polarisations were adjusted until the fundamental emission amplitude was maximised on the spectrum analyser. The peak fundamental emission amplitude was determined using a peak marker function on the maximised trace.

The EUT was substituted with a calibrated transmitting antenna connected to a calibrated signal generator using an RF cable. The signal generator was configured to transmit CW at the frequency of the previously measured fundamental emission. The signal generator output level

was adjusted until the spectrum analyser measured a signal level equal to the previous peak fundamental emission amplitude; yielding a value for PSigGen.

The substitution antenna gain (GT) and the RF cable loss (LC) for the emission frequency were applied to the value of PSigGen using the previously defined ERP formula. The result of which determined the peak ERP of the fundamental emission.

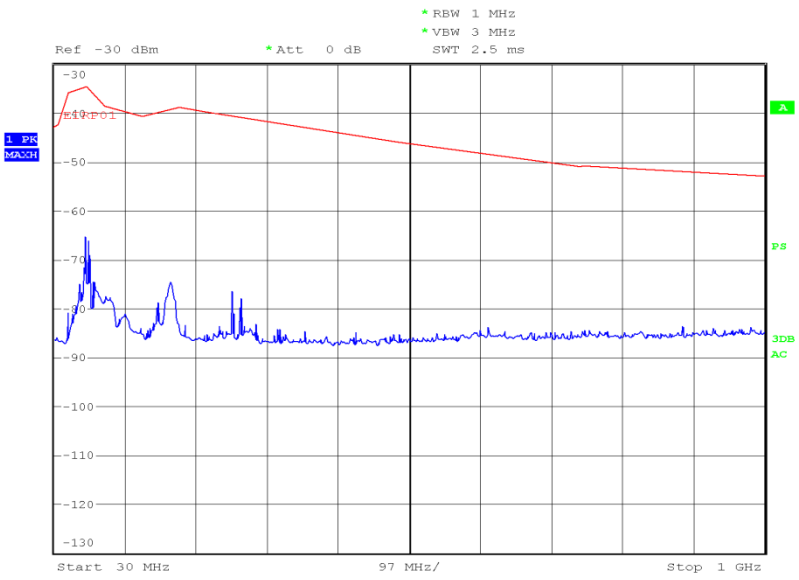
2.6.6 Environmental Conditions

Ambient Temperature	20.8°C
Relative Humidity	33.0%

2.6.7 Test Results

1850.2 MHz

30 MHz to 1 GHz



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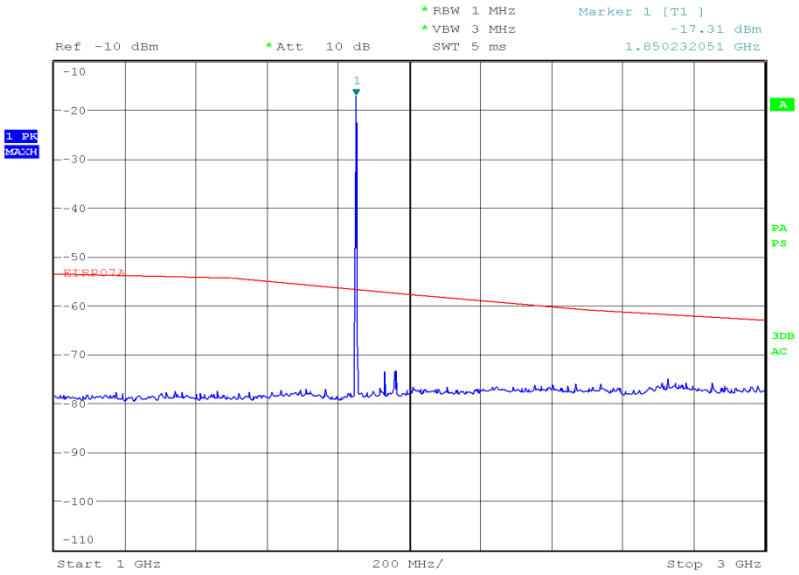
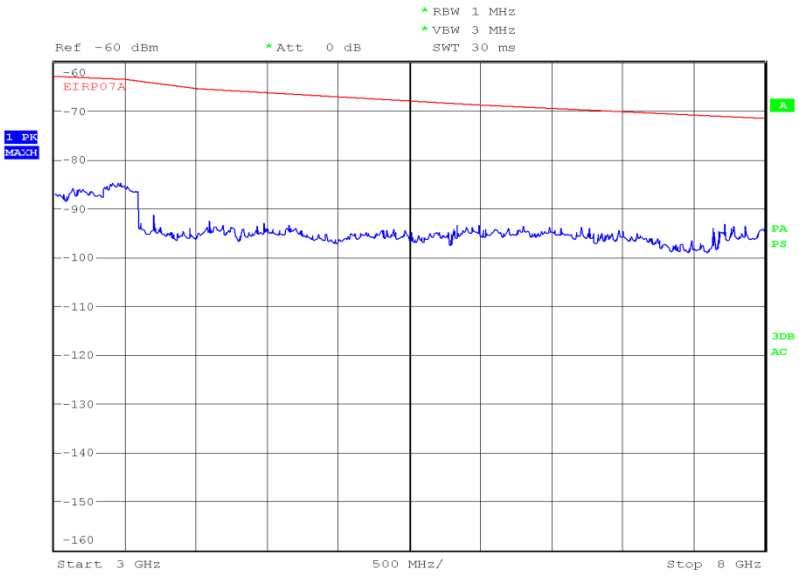
1 GHz to 3 GHz



3 GHz to 8 GHz



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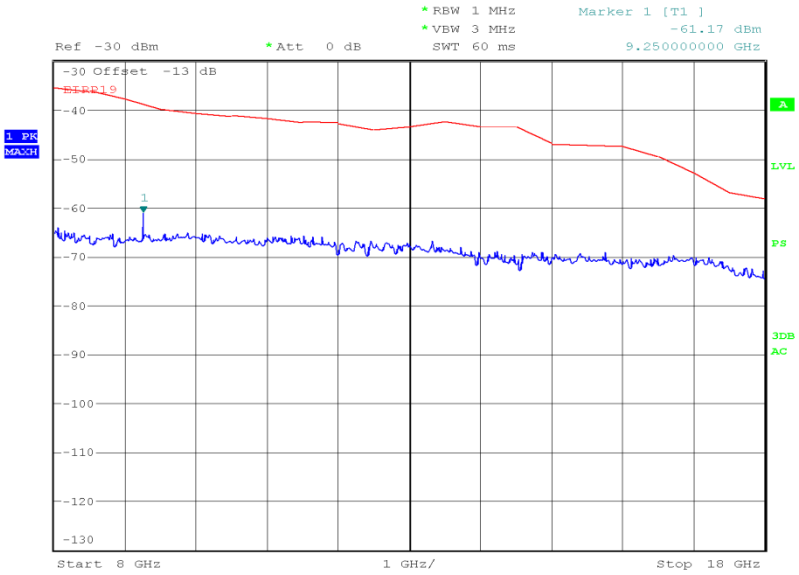
8 GHz to 18 GHz



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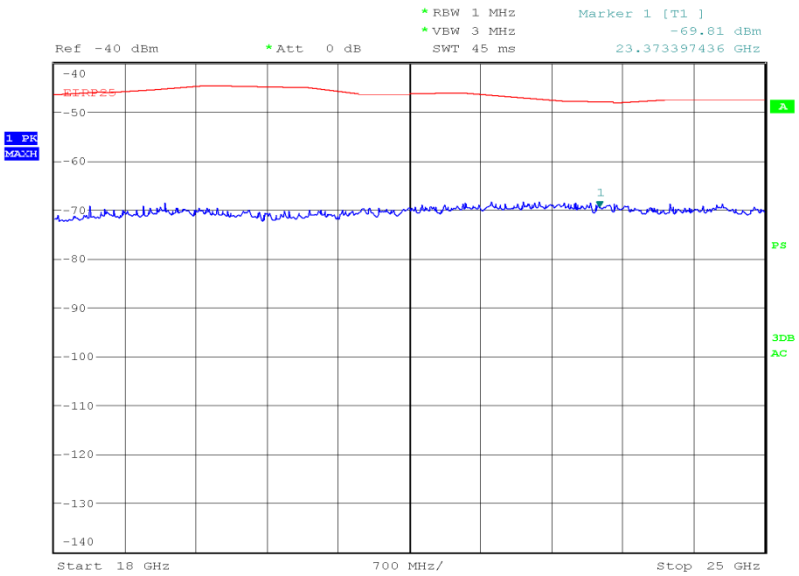
18 GHz to 25 GHz



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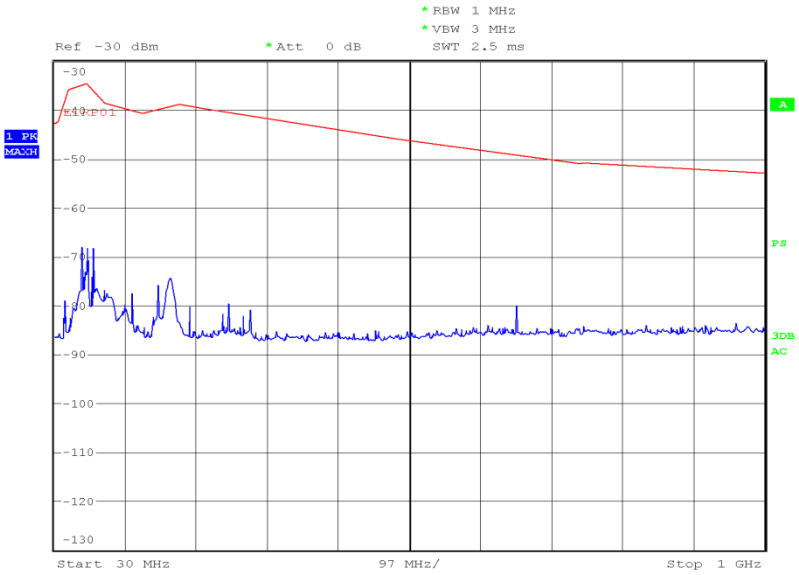
1880.0 MHz

30 MHz to 1 GHz



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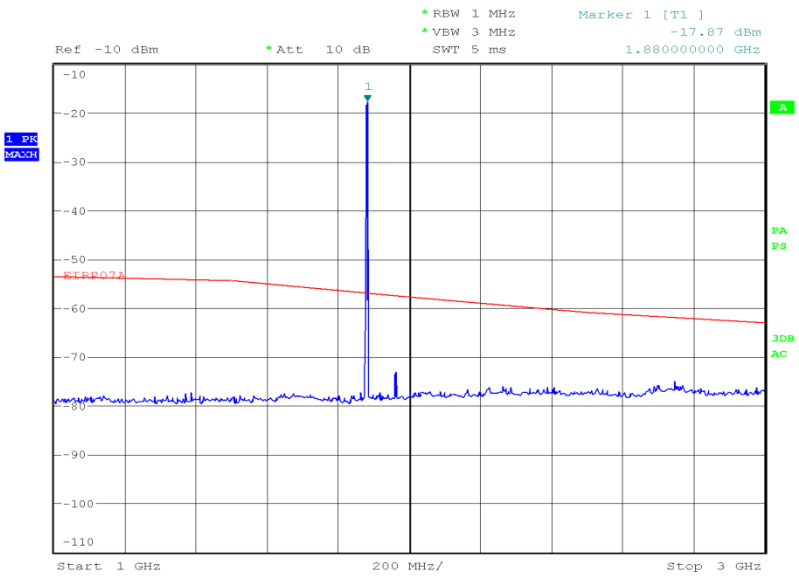
1 GHz to 3 GHz



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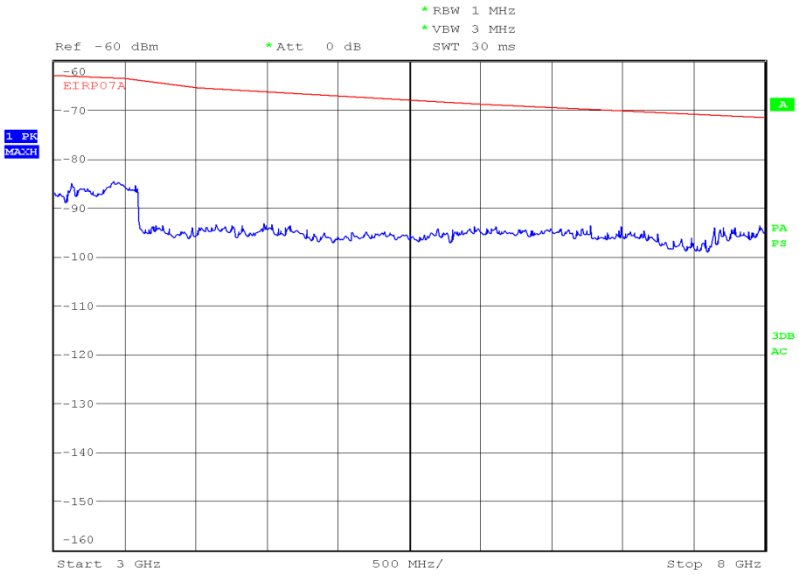
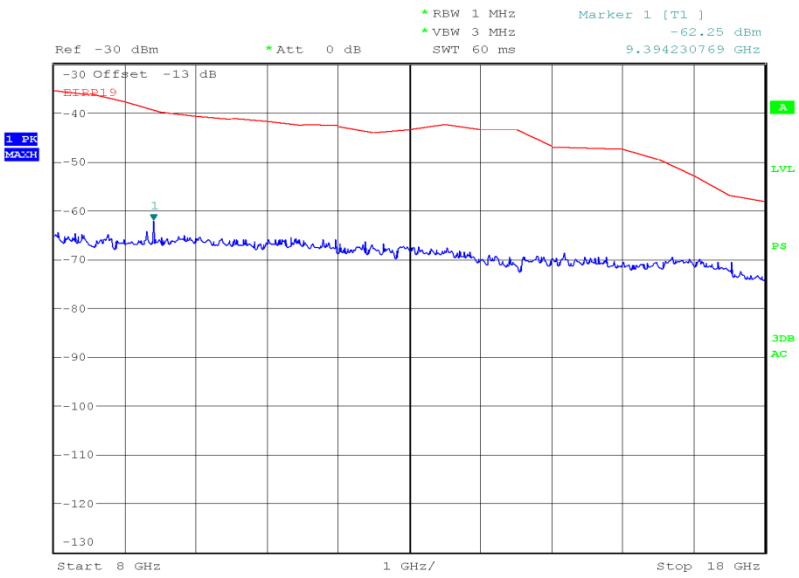
Product Service

3 GHz to 8 GHz



Date: 21.DEC.2014 14:30:05

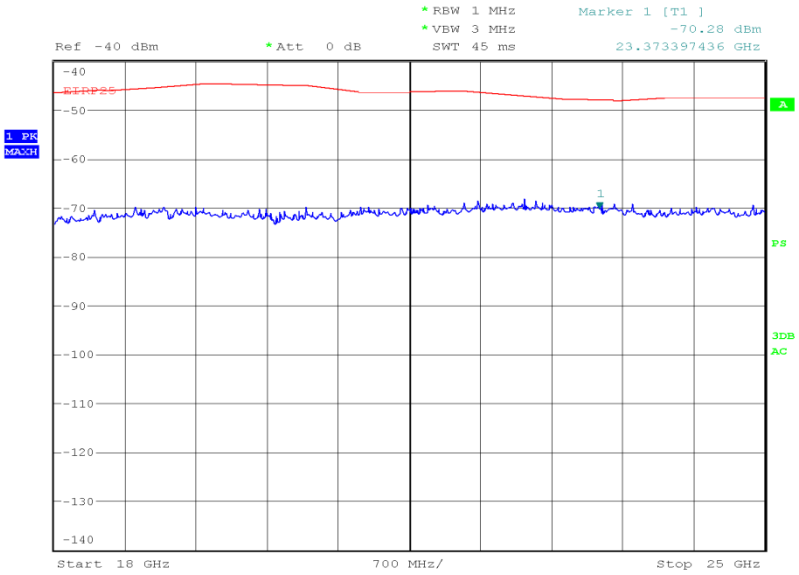
8 GHz to 18 GHz



Date: 21.DEC.2014 14:48:54

Product Service

18 GHz to 25 GHz

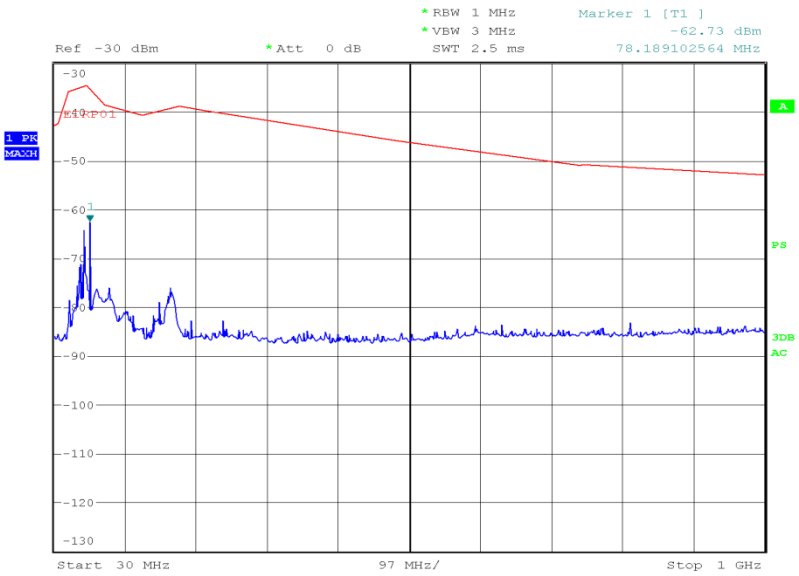


Date: 21.DEC.2014 16:14:45

COMMERCIAL-IN-CONFIDENCE

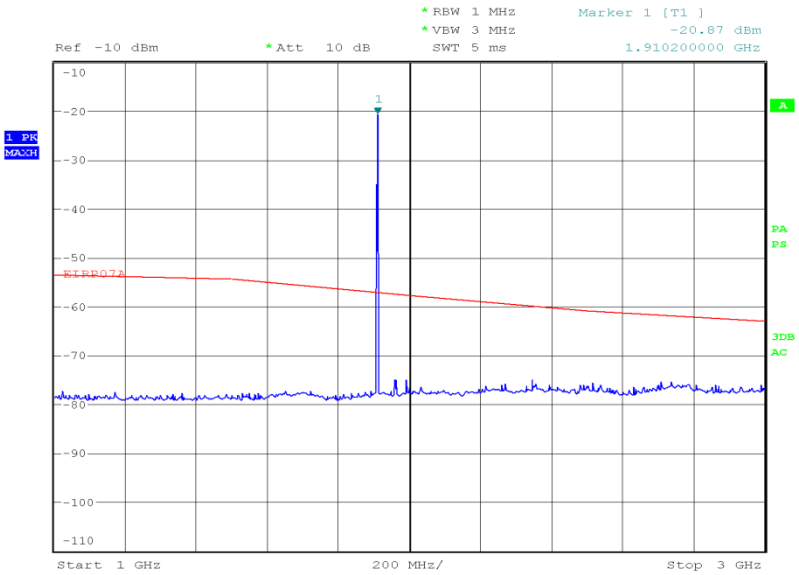
1909.8 MHz

30 MHz to 1 GHz



Date: 21.DEC.2014 15:02:12

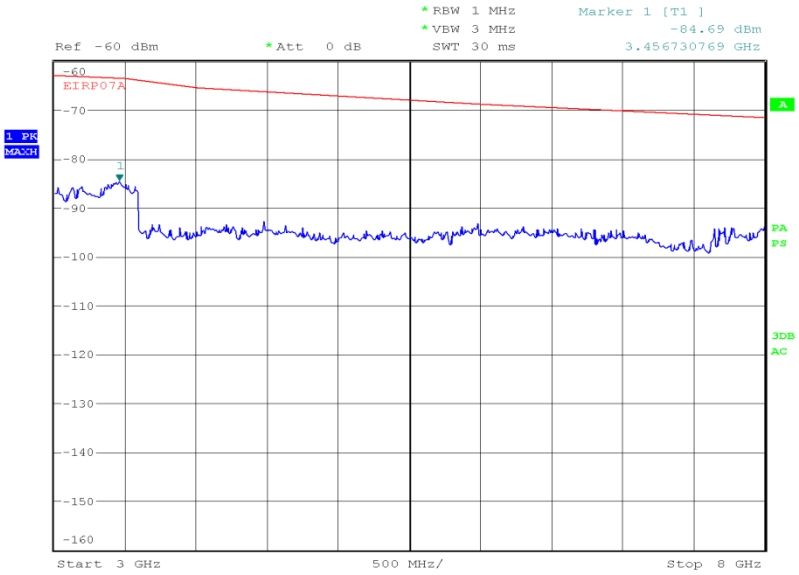
1 GHz to 3 GHz



Date: 21.DEC.2014 10:32:07

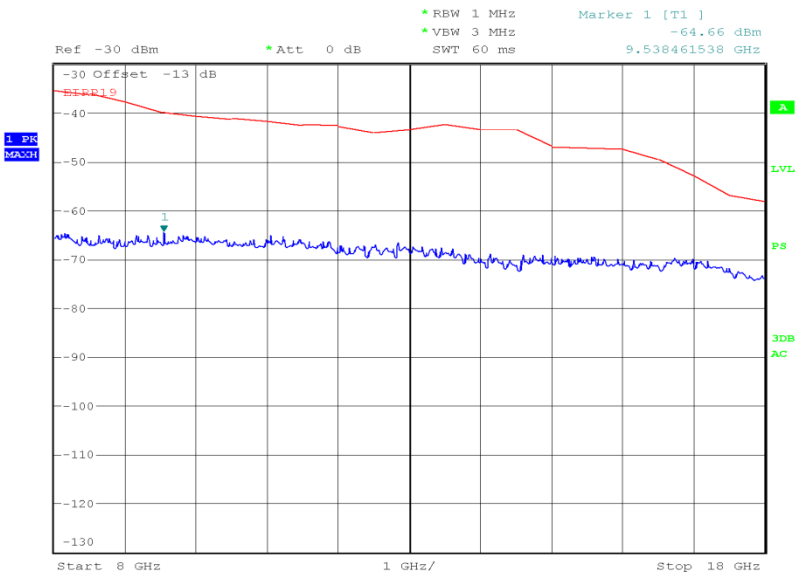
Product Service

3 GHz to 8 GHz



Date: 21.DEC.2014 14:31:45

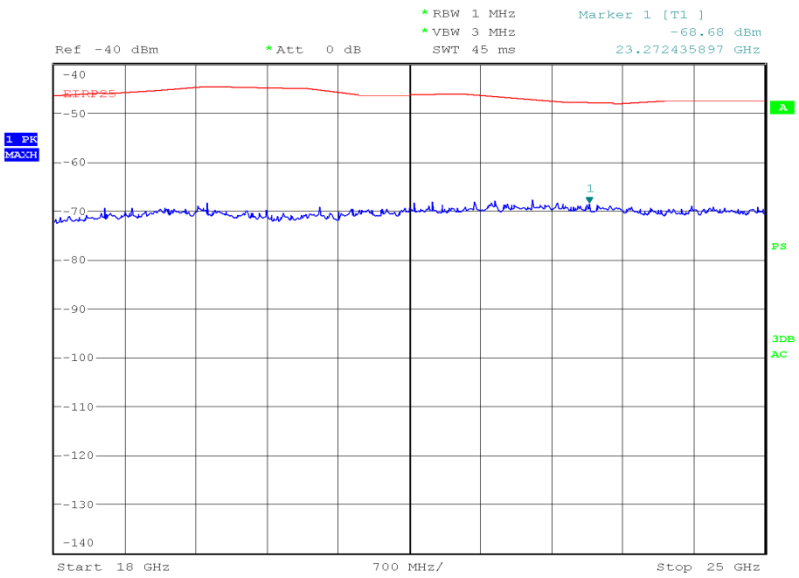
8 GHz to 18 GHz



Date: 21.DEC.2014 14:47:15

Product Service

18 GHz to 25 GHz



Date: 21.DEC.2014 16:12:14

Limit Clause

Out of band emissions: The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

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

S/N: IMEI 004401115346674 - Modification State 0

2.7.3 Date of Test

17 December 2014

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

Measurements were performed in accordance with KDB 971168 v02r02 clause 6.

The EUT was connected to a spectrum analyser via a cable, combiner and attenuator, additionally between 3GHz and 20GHz a 3GHz high pass filter was used. The other port of the combiner was connected to a communications test set which was configured with a circuit switched voice call at maximum output power. The path loss was calibrated using a vector network analyser and the value with the highest loss for the frequency range of interest was entered as a reference level offset on the spectrum analyser. The RBW was configured with an RBW of 1 MHz using a peak detector and max hold trace.

2.7.6 Environmental Conditions

Ambient Temperature	24.4°C
Relative Humidity	47.8%

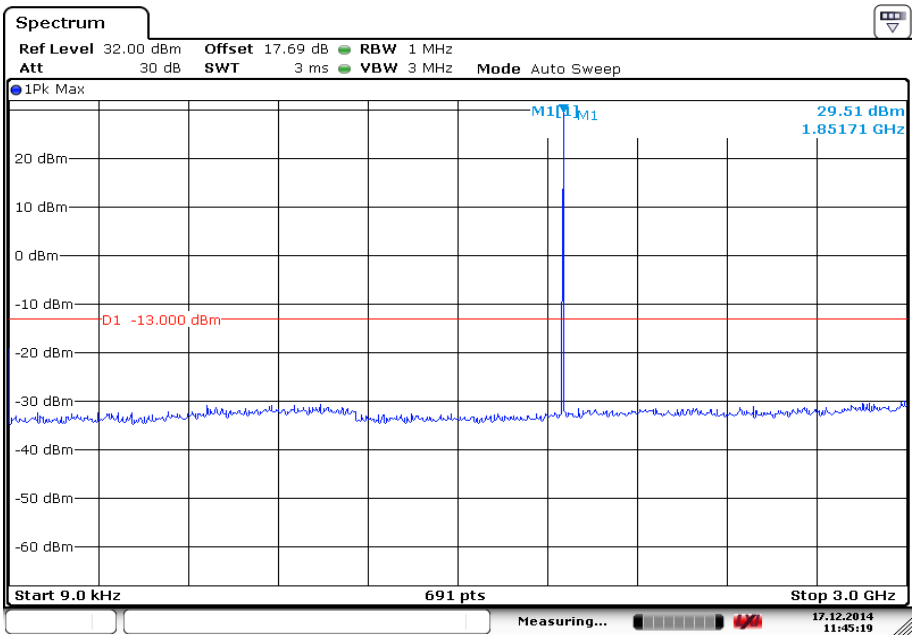
Product Service

2.7.7 Test Results

4.0 V DC Supply

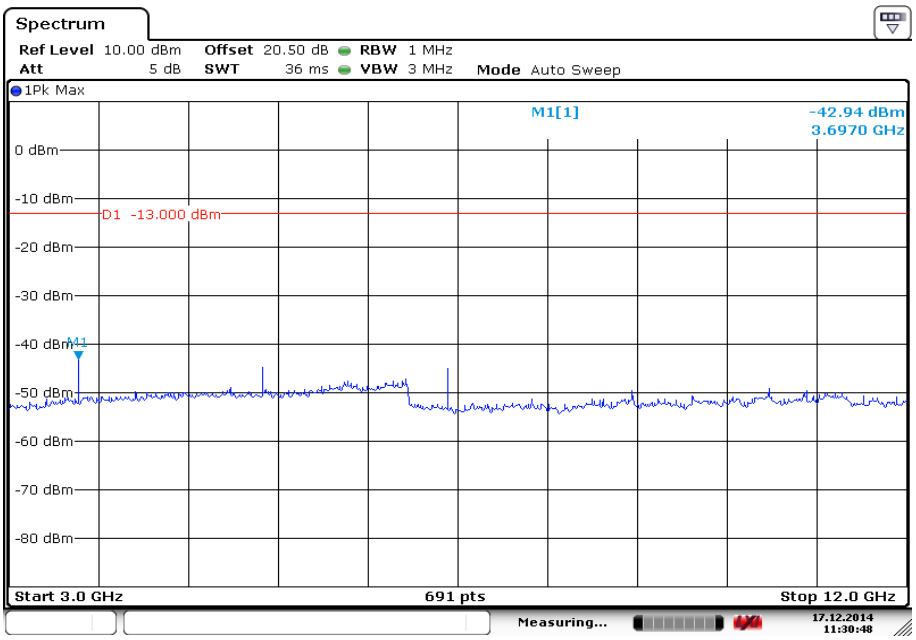
1850.2 MHz

9 kHz to 3 GHz



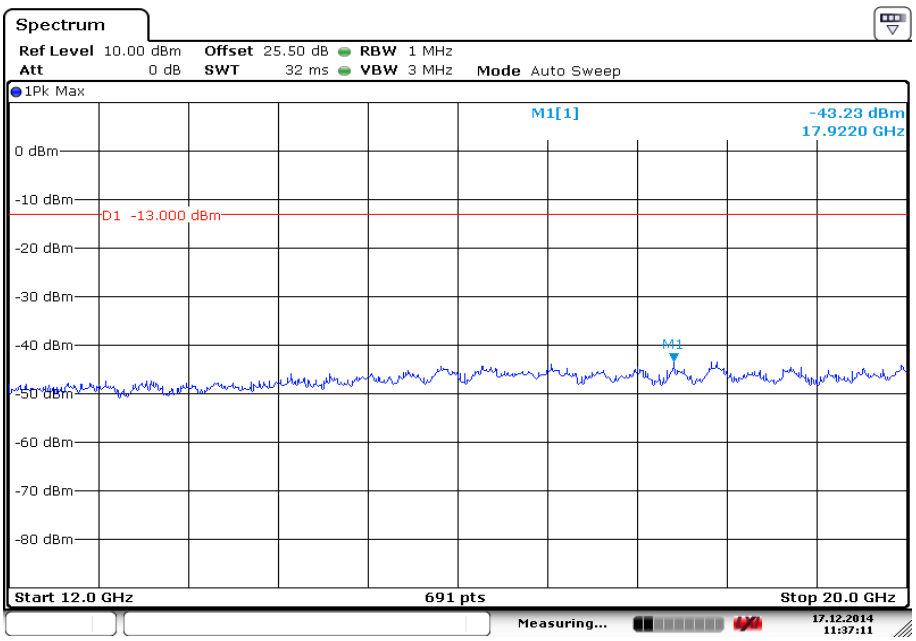
Product Service

3 GHz to 12 GHz



Date: 17.DEC.2014 11:30:48

12 GHz to 20 GHz

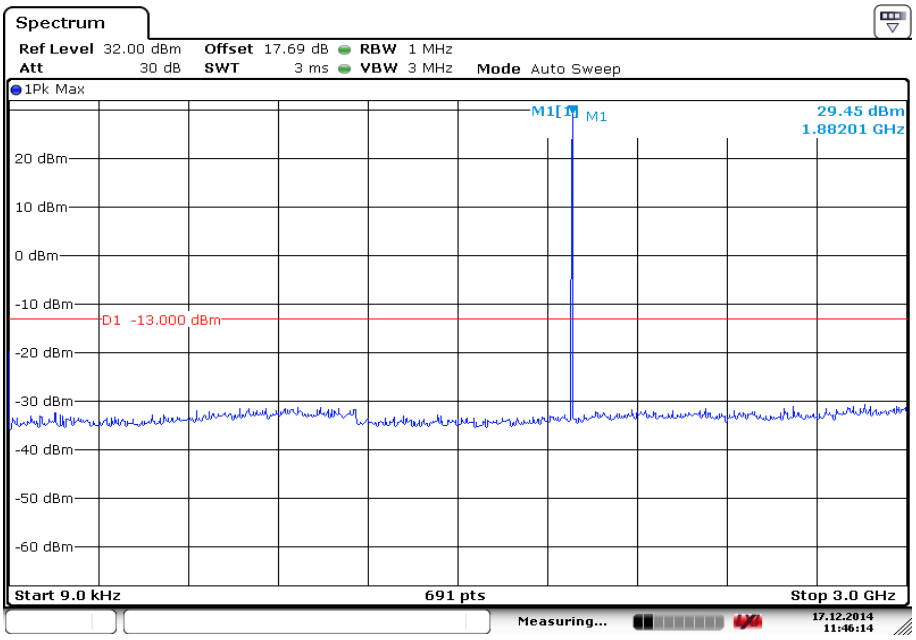


Date: 17.DEC.2014 11:37:11

Product Service

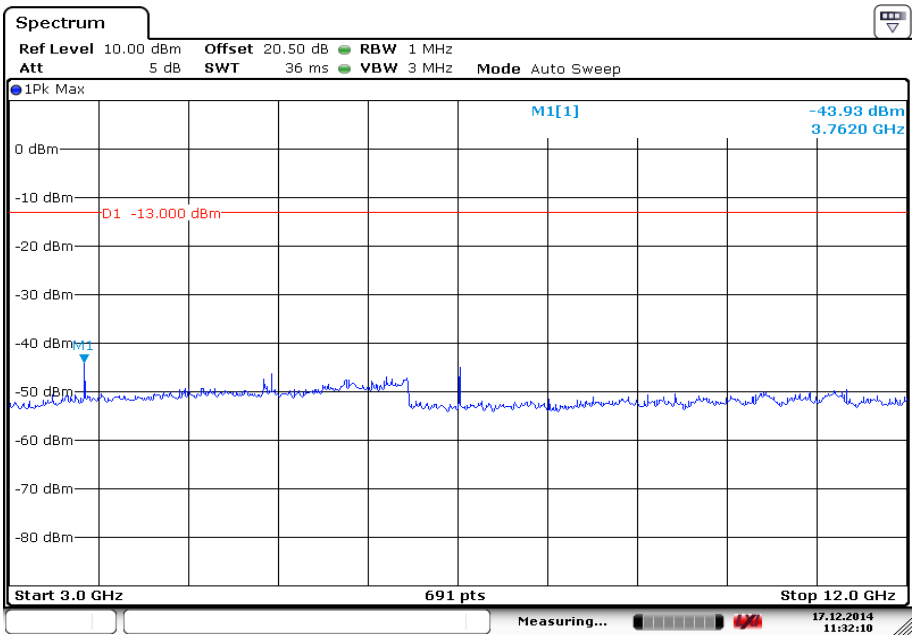
1880.0 MHz

9 kHz to 3 GHz



Date: 17.DEC.2014 11:46:13

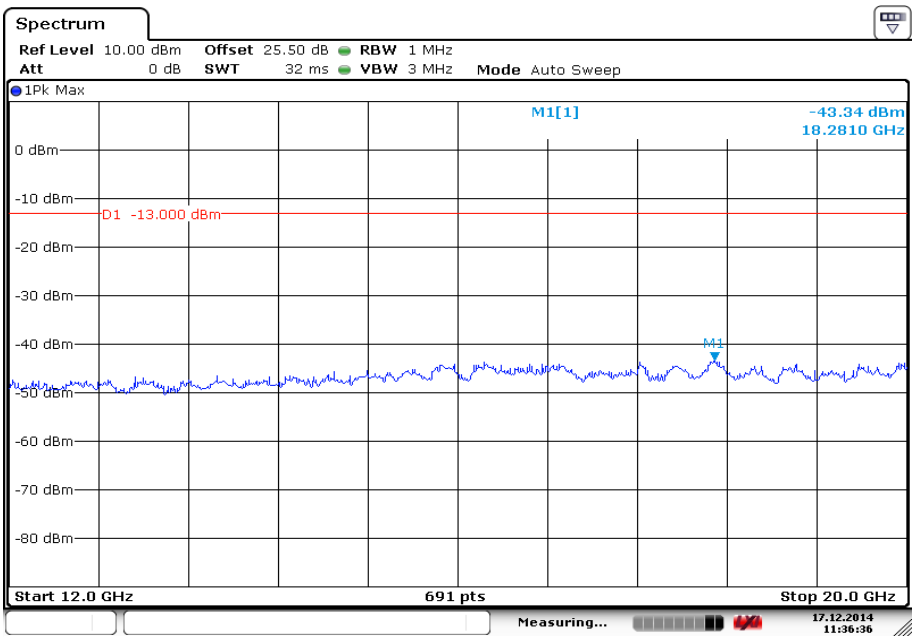
3 GHz to 12 GHz



Date: 17.DEC.2014 11:32:10

Product Service

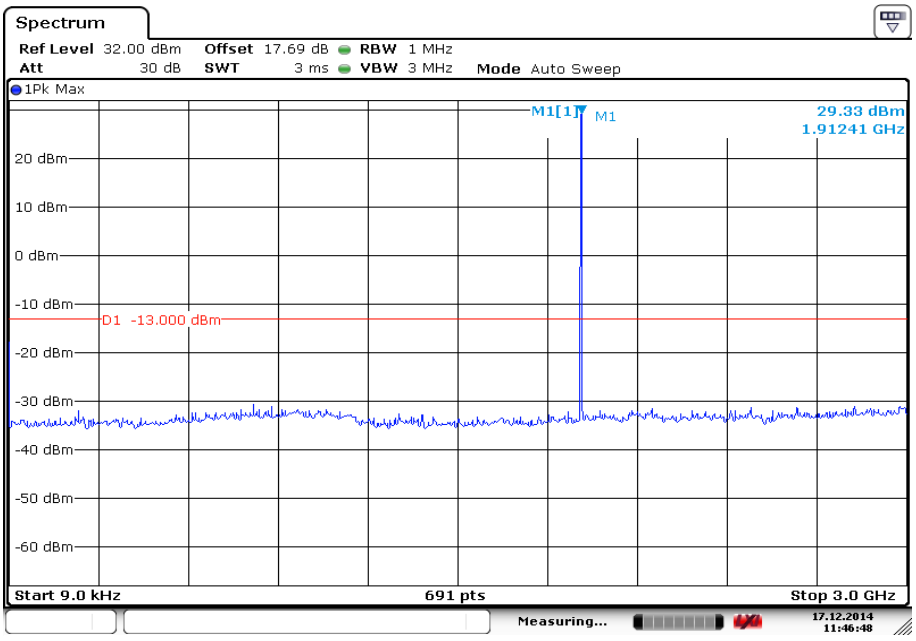
12 GHz to 20 GHz



Date: 17.DEC.2014 11:36:36

1909.8 MHz

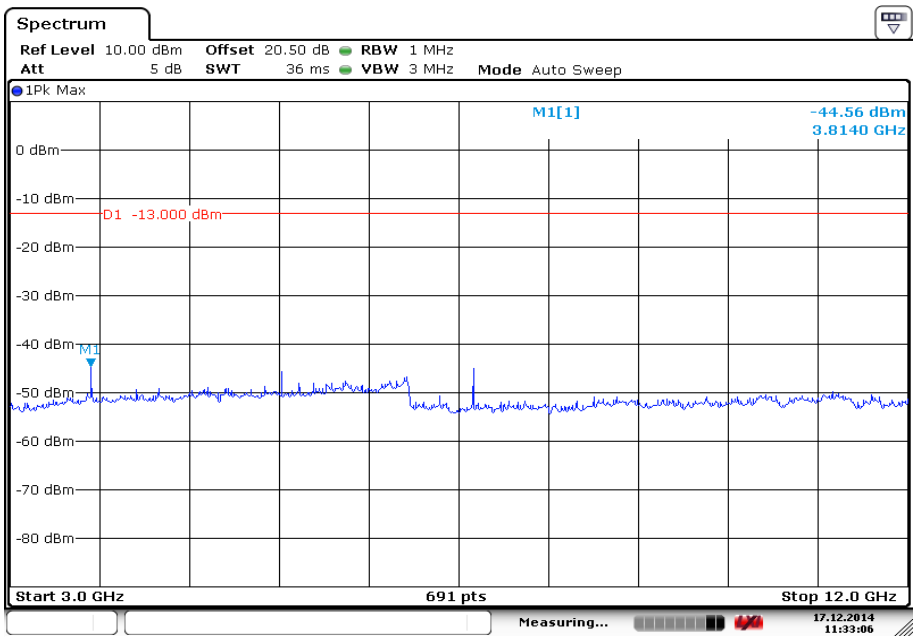
9 kHz to 3 GHz



Date: 17.DEC.2014 11:46:48

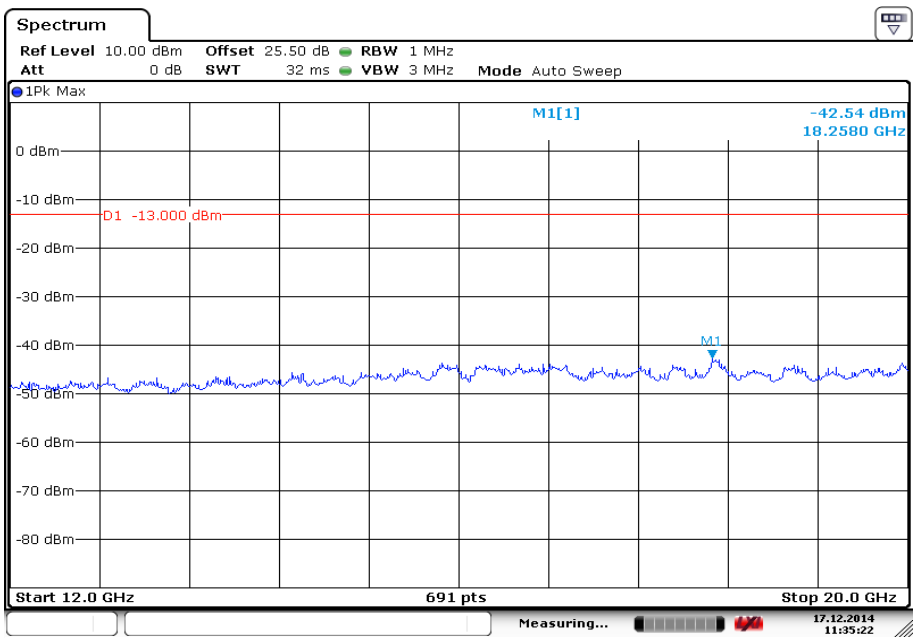
Product Service

3 GHz to 12 GHz



Date: 17.DEC.2014 11:33:05

12 GHz to 20 GHz



Date: 17.DEC.2014 11:35:22

Limit Clause

Out of band emissions: The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

2.8 EMISSION 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

S/N: IMEI 004401115346674 - Modification State 0

2.8.3 Date of Test

16 December 2014

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

Measurements were performed in accordance with KDB 971168 v02r02 clause 4.1.

The EUT was connected to a spectrum analyser via a cable, combiner and attenuator. The other port of the combiner was connected to a communications test set which was configured with a circuit switched voice call at maximum output power. The path loss was calibrated using a vector network analyser and was entered as a reference level offset on the spectrum analyser. The 26 dB points either side of the peak were found using the spectrum analysers markers and the delta reading was recorded.

2.8.6 Environmental Conditions

Ambient Temperature	22.3°C
Relative Humidity	29.8%

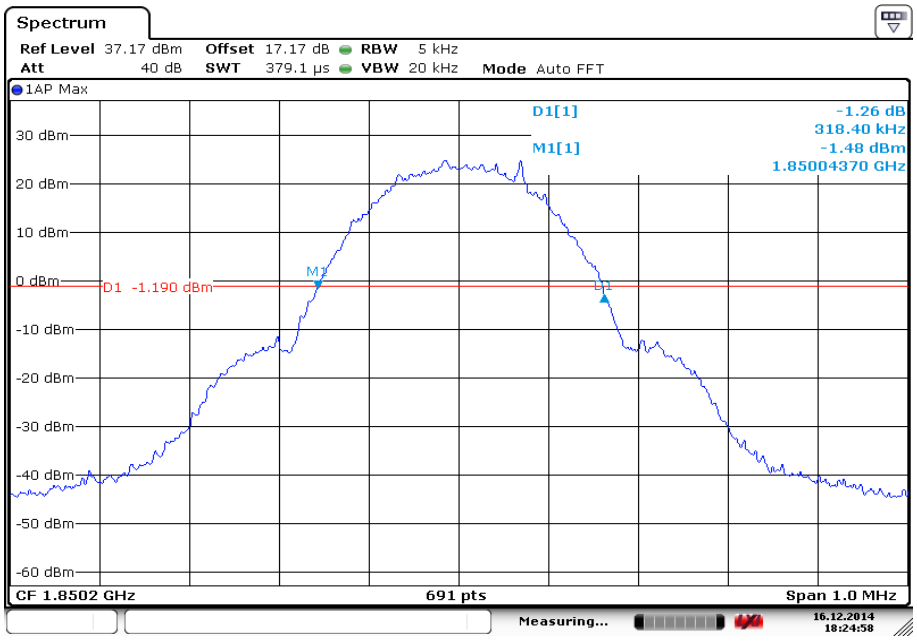
Product Service

2.8.7 Test Results

4.0 V DC Supply

1850.2 MHz

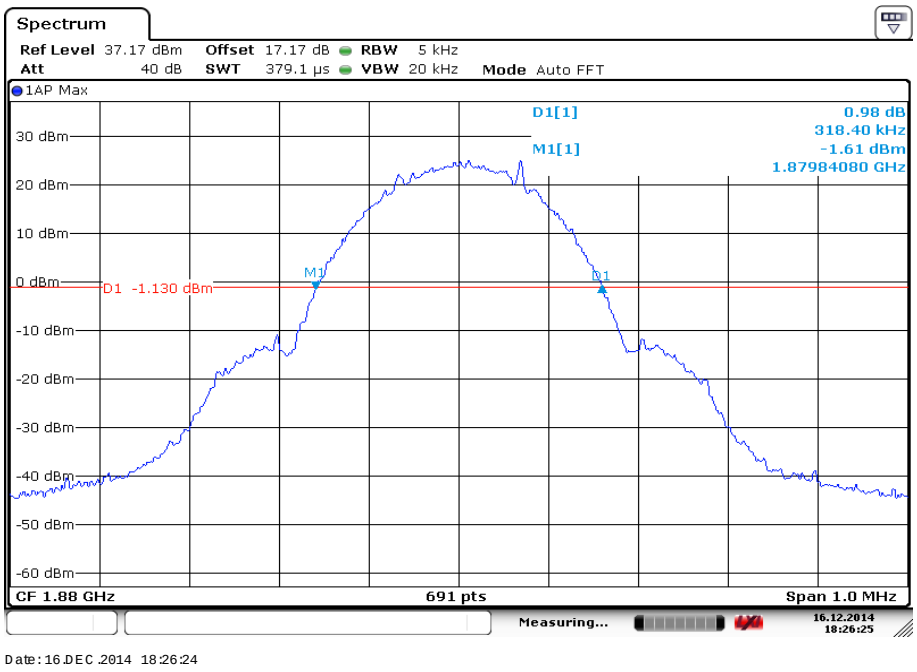
Mode	Emission Bandwidth (kHz)
GMSK	318.40



Date: 16.DEC.2014 18:24:58

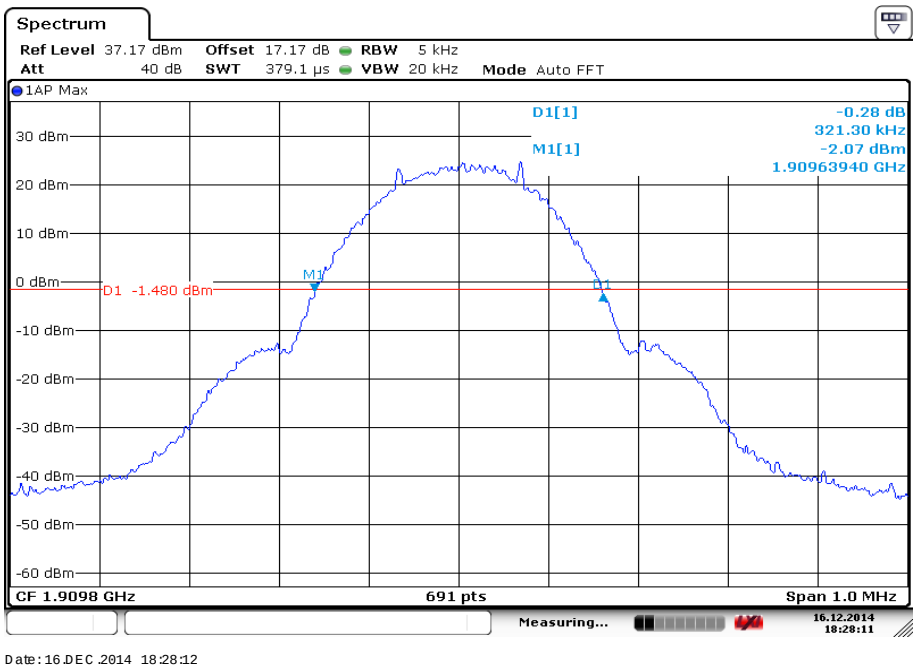
1880.0 MHz

Mode	Emission Bandwidth (kHz)
GMSK	318.40



1909.8 MHz

Mode	Emission Bandwidth (kHz)
GMSK	321.30



Date: 16.DEC.2014 18:28:12

Limit Clause

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

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					
Power Supply Unit	Hewlett Packard	6282A	132	-	TU
Temperature Chamber	Montford	2F3	467	-	O/P Mon
Attenuator: 10dB/20W	Narda	766-10	480	12	3-Dec-2015
Multimeter	Fluke	79 Series III	611	12	1-Sep-2015
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Thermocouple Thermometer	Fluke	51	3174	12	4-Dec-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
2 Metre SMA Type Cable	Rhophase	3PS-1801A-2000-3PS	4111	12	7-Nov-2015
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	4143	12	29-Aug-2015
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	18-Jan-2015
Section 2.2 - Spurious Emissions at Band Edge					
Power Supply Unit	Farnell	LT30-2	41	-	O/P Mon
Attenuator 10dB/25W	Weinschel	46-10-43	400	12	4-Jun-2015
Power Divider	Weinschel	1506A	603	12	28-May-2015
Multimeter	Fluke	79 Series III	611	12	1-Sep-2015
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Radio Communications Test Set	Rohde & Schwarz	CMU 200	3035	12	6-Nov-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	18-Jan-2015
Signal Analyser	Rohde & Schwarz	FSV-40	S/N: 10-300333310	12	14-Nov-2015
Section 2.3 - Effective Isotropic Radiated Power					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	2-May-2015
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	22	28-Nov-2015
Communications Tester	Rohde & Schwarz	CMU 200	442	-	TU*
Screened Room (5)	Rainford	Rainford	1545	24	10-Jan-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	10-Feb-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
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
Section 2.4 - Maximum Peak Output Power - Conducted					
Power Supply Unit	Farnell	LT30-2	41	-	O/P Mon
Attenuator 10dB/25W	Weinschel	46-10-43	400	12	4-Jun-2015
Communications Tester	Rohde & Schwarz	CMU 200	442	-	TU*
Attenuator: 10dB/20W	Narda	766-10	480	12	3-Dec-2015
Multimeter	Fluke	79 Series III	611	12	1-Sep-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
P-Series Power Meter	Agilent Technologies	N1911A	3981	12	22-Sep-2015
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3983	12	22-Sep-2015

Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6 - Emission Limitations for Broadband PCS Equipment					
Antenna (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	26-Nov-2015
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	2-May-2015
Filter (High Pass)	Lorch	SHP7-7000-SR	566	12	24-Feb-2015
Pre-Amplifier	Phase One	PSO4-0087	1534	12	18-Dec-2015
Screened Room (5)	Rainford	Rainford	1545	24	10-Jan-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
Amplifier (8 - 18GHz)	Phase One	PS06-0061	3176	12	11-Aug-2015
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	10-Feb-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
'3.5mm' - '3.5mm' RF Cable (1m)	Rhophase	3PS-1803-1000-3PS	3697	12	28-Feb-2015
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
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4412	12	21-Mar-2015
Section 2.7 - Conducted Spurious Emissions					
Power Supply Unit	Farnell	LT30-2	41	-	O/P Mon
Attenuator 10dB/25W	Weinschel	46-10-43	400	12	4-Jun-2015
Power Divider	Weinschel	1506A	603	12	28-May-2015
Multimeter	Fluke	79 Series III	611	12	1-Sep-2015
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Filter	Daden Anthony Ass	MH-1500-7SS	2778	12	4-Feb-2015
Radio Communications Test Set	Rohde & Schwarz	CMU 200	3035	12	6-Nov-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	4143	12	29-Aug-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-2015
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	18-Jan-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4411	12	21-Mar-2015
Section 2.8 - Emission Bandwidth					
Power Supply Unit	Farnell	LT30-2	41	-	O/P Mon
Attenuator 10dB/25W	Weinschel	46-10-43	400	12	4-Jun-2015
RF Coupler	TUV SUD Product Service	RFC1	414	-	TU
Power Divider	Weinschel	1506A	603	12	28-May-2015
Multimeter	Fluke	79 Series III	611	12	1-Sep-2015
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
ESA-E Series Spectrum Analyser	Agilent Technologies	E4402B	3348	12	5-Sep-2015
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	4143	12	29-Aug-2015
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	18-Jan-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Signal Analyser	Rohde & Schwarz	FSV-40	S/N: 10-300333310	12	14-Nov-2015

* Not used for qualitative measurements

TU – Traceability Unscheduled and 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
Modulation Characteristics	-
Emission Bandwidth	± 10.14 kHz
Maximum Peak Output Power - Conducted	± 0.70 dB
Spurious Emissions at Band Edge	± 2.20 dB
Emission Limitations for Broadband PCS Equipment	± 3.08 dB
Conducted Spurious Emissions	± 3.454 dB
Frequency Stability	± 99.54 Hz
Effective Isotropic Radiated Power	± 3.08 dB

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).