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Report On

FCC Testing of the Sharp Hep-band LTE (B1 / B3 / B5 / B13 / B17 / B26 / B38), Dual-band WCDMA (FDD I / V), Quad-band GSM (850 / 900 / 1800 / 1900) & WiMAX2+ (TDD41) multi mode Smart phone with Bluetooth, WLAN, SRD(NFC, FeliCa) and GPS in accordance with FCC 47 CFR Part 24 and FCC 47 CFR Part 2 (PCS 1900)

COMMERCIAL-IN-CONFIDENCE

FCC ID: APYHRO00234

Document 75933606 Report 19 Issue 1 **May 2016**

Product Service

TÜV SÜD Product Service, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
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REPORT ON

FCC Testing of the Sharp Hep-band LTE (B1 / B3 / B5 / B13 / B17 / B26 / B38), Dual-band WCDMA (FDD I / V), Quad-band GSM (850 / 900 / 1800 / 1900) & WiMAX2+ (TDD41) multi mode Smart phone with Bluetooth, WLAN, SRD(NFC, FeliCa) and GPS in accordance with FCC 47 CFR Part 24 and FCC 47 CFR Part 2 (PCS 1900)

Document 75933606 Report 19 Issue 1

May 2016

PREPARED FOR

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Authorised Signatory

DATED 05 May 2016

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 47 CFR Part 24 and FCC 47 CFR Part 2. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

M Toubella M Russell T Guy

UKAS TESTING 0141

Product Service

CONTENTS

Product Service

SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp Hep-band LTE (B1 / B3 / B5 / B13 / B17 / B26 / B38), Dual-band WCDMA (FDD I / V), Quad-band GSM (850 / 900 / 1800 / 1900) & WiMAX2+ (TDD41) multi mode Smart phone with Bluetooth, WLAN, SRD(NFC, FeliCa) and GPS
In accordance with FCC 47 CFR Part 24 and FCC 47 CFR Part 2 (PCS 1900)

Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC Testing of the Sharp Hep-band LTE (B1 / B3 / B5 / B13 / B17 / B26 / B38), Dual-band WCDMA (FDD I / V), Quad-band GSM (850 / 900 / 1800 / 1900) & WiMAX2+ (TDD41) multi mode Smart phone with Bluetooth, WLAN, SRD(NFC, FeliCa) and GPS to the requirements of FCC 47 CFR Part 24 and FCC 47 CFR Part 2.

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 004401115723286 IMEI 004401115723823
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 24 (2015) FCC 47 CFR Part 2 (2015)
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	10749 15 February 2016
Start of Test	23 March 2016
Finish of Test	8 April 2016
Name of Engineer(s)	M Toubella M Russell T Guy
Related Document(s)	ANSI C63.4 (2014) ANSI TIA-603-D (2010)

Product Service

1.2 BRIEF SUMMARY OF RESULTS

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

Section	Specification Clause		Test Description	Result	Comments/Base Standard
	Part 24	Part 2			
PCS 1900					
2.1	24.229 and 24.238	2.1051	Spurious Emissions at Band Edge	Pass	
2.2	24.232	2.1046	Maximum Conducted Output Power	Pass	
2.3	24.235	2.1055	Frequency Stability	Pass	
2.4	24.238	2.1053	Emission Limitations for Broadband PCS Equipment	Pass	
2.5	24.238	2.1049 (h)	26 dB Bandwidth	Pass	
2.6	24.238 (a)	2.1051	Spurious Emissions at Antenna Terminals	Pass	
2.7	-	2.1047 (d)	Modulation Characteristics	-	Customer Declaration

Product Service

1.3 PRODUCT TECHNICAL DESCRIPTION

Refer to Model Description APYHRO00234 Rev 4.0 document.

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp Hep-band LTE (B1 / B3 / B5 / B13 / B17 / B26 / B38), Dual-band WCDMA (FDD I / V), Quad-band GSM (850 / 900 / 1800 / 1900) & WiMAX2+ (TDD41) multi mode Smart phone with Bluetooth, WLAN, SRD(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 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 Hep-band LTE (B1 / B3 / B5 / B13 / B17 / B26 / B38), Dual-band WCDMA (FDD I / V), Quad-band GSM (850 / 900 / 1800 / 1900) & WiMAX2+ (TDD41) multi mode Smart phone with Bluetooth, WLAN, SRD(NFC, FeliCa) and GPS
In accordance with FCC 47 CFR Part 24 and FCC 47 CFR Part 2 (PCS 1900)

2.1 SPURIOUS EMISSIONS AT BAND EDGE

2.1.1 Specification Reference

FCC 47 CFR Part 24, Clause 24.229 and 24.238
FCC 47 CFR Part 2, Clause 2.1051

2.1.2 Equipment Under Test and Modification State

S/N: IMEI 004401115723286 - Modification State 0

2.1.3 Date of Test

31 March 2016

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 performed in accordance with KDB 971168 D01 v02r02, Clause 6.

2.1.6 Environmental Conditions

Ambient Temperature	21.0°C
Relative Humidity	33.6%

Product Service

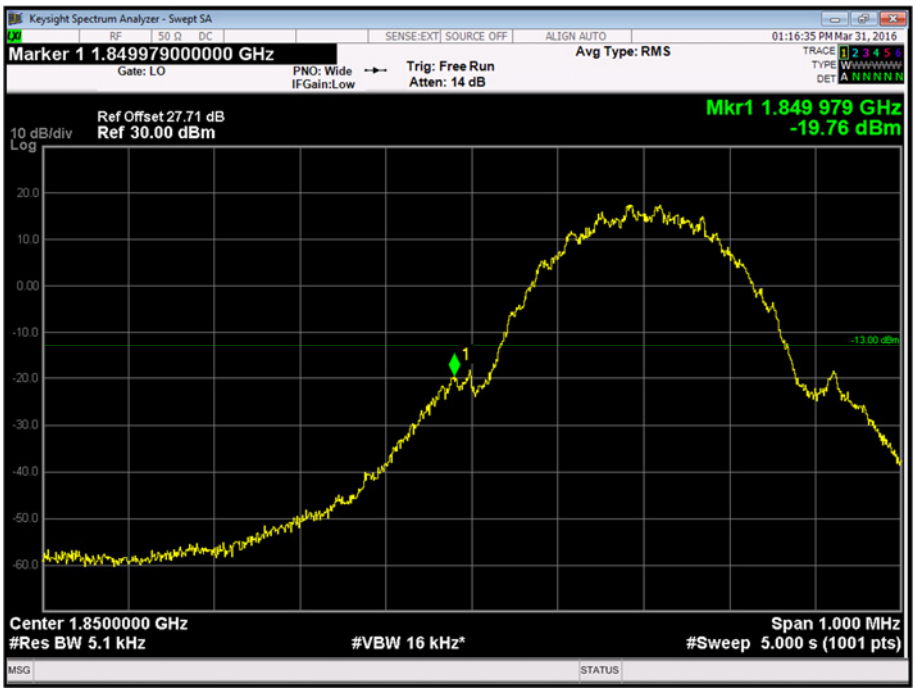
2.1.7 Test Results

4.0 V DC Supply

PCS 1900, Circuit-Switched (Voice), GMSK, Spurious Emissions at Band Edge Results

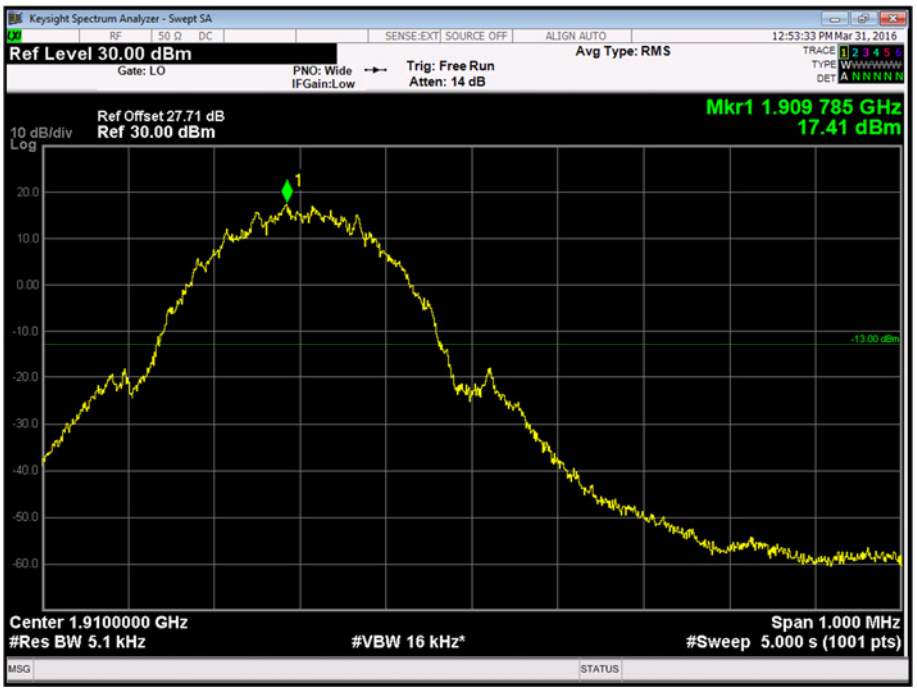
Block Edge	Frequency Block (MHz)	
	A :1850 MHz – 1865 MHz	C :1895 MHz – 1910 MHz
Lower	Channel: 512 1850.2 MHz	-
Upper	-	Channel: 810 1909.8 MHz

PCS 1900, Circuit-Switched (Voice), GMSK, Frequency Block A, Spurious Emissions at Band Edge Plot



Product Service

PCS 1900, Circuit-Switched (Voice), GMSK, Frequency Block C, Spurious Emissions at Band Edge Plot



FCC 47 CFR Part 24, Limit Clause 24.229 (a)

Mobile Transmitters:

Block A: 1850 to 1865 MHz paired with 1930 to 1945 MHz
Block B: 1870 to 1885 MHz paired with 1950 to 1965 MHz

FCC 47 CFR Part 24, Limit Clause 24.238 (a)

43 + 10 log (P) dB or -13 dBm.

Product Service

2.2 MAXIMUM CONDUCTED OUTPUT POWER

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

S/N: IMEI 004401115723286 - Modification State 0

2.2.3 Date of Test

23 March 2016

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

The test was performed in accordance with KDB 971168 D01 v02r02, clause 5.2.3.

Remarks

The EUT could not be configured to transmit continuously therefore the power meter was gated so that the measurement was only performed over the active transmission burst.

The antenna gain was declared by the manufacturer as 2.0 dBi. EIRP was then calculated using the following formula:

EIRP = Pout (dBm) + ANT Gain (dBi)

2.2.6 Environmental Conditions

Ambient Temperature	23.3°C
Relative Humidity	25.6%

Product Service

2.2.7 Test Results

4.0 V DC Supply

PCS 1900, Circuit-Switched (Voice), Maximum Peak Conducted Output Power Results

Frequency	Conducted Power (dBm)	Antenna Gain	EIRP (dBm)	EIRP (W)
1850.2 MHz	29.80	2.0 dBi	31.80	1.51
1880.0 MHz	29.56	2.0 dBi	31.56	1.43
1909.8 MHz	29.34	2.0 dBi	31.34	1.36

FCC 47 CFR Part 24, Limit Clause 24.232 (c)

Mobile and portable stations: 2 Watts.

2.3 FREQUENCY STABILITY

2.3.1 Specification Reference

FCC 47 CFR Part 24, Clause 24.235
FCC 47 CFR Part 2, Clause 2.1055

2.3.2 Equipment Under Test and Modification State

S/N: IMEI 004401115723286 - Modification State 0

2.3.3 Date of Test

8 April 2016

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

This test was performed in accordance with FCC 47 CFR Part 2, clause 2.1055.

Remarks

A radio communications test set frequency measurement function was used to measure the frequency error. The radio communications test set was configured for an uplink frequency of 1880.0 MHz and the frequency reference was set to an external 10MHz rubidium frequency standard.

2.3.6 Environmental Conditions

Ambient Temperature	24.7 - 25.6°C
Relative Humidity	30.0 - 30.5%

Product Service

2.3.7 Test Results

PCS 1900, 1880.0 MHz, Circuit-Switched (Voice),GMSK, Frequency Stability Under Temperature Variations Results

Temperature	Fundamental Measured Frequency (MHz)
-30 ºC	0.032
-20 ºC	0.035
-10 ºC	0.031
0 ºC	0.035
+10 ºC	0.038
+20 ºC	0.035
+30 ºC	0.042
+40 ºC	0.028
+50 ºC	0.024

PCS 1900, 1880.0 MHz, Circuit-Switched (Voice), GMSK, Frequency Stability Under Voltage Variations Results

Voltage	Fundamental Measured Frequency (MHz)
4.0 V DC	0.035
3.7 V DC	0.022

Remark

The measured frequency error over temperature and voltage extremes does not cause the fundamental emission to go outside the authorised frequency block.

FCC 47 CFR Part 24, Limit Clause 24.235

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

Product Service

2.4 EMISSION LIMITATIONS FOR BROADBAND PCS EQUIPMENT

2.4.1 Specification Reference

FCC 47 CFR Part 24, Clause 24.238
FCC 47 CFR Part 2, Clause 2.1053

2.4.2 Equipment Under Test and Modification State

S/N: IMEI 004401115723823 - Modification State 0

2.4.3 Date of Test

2 April 2016

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

The test was performed in accordance with KDB 971168 D01 v02r02, Clause 5.8 and 7 and ANSI TIA-603-D, Clause 2.2.12. The EUT was configured as defined in ANSI C63.4.

2.4.6 Environmental Conditions

Ambient Temperature	20.1°C
Relative Humidity	33.0%

Product Service

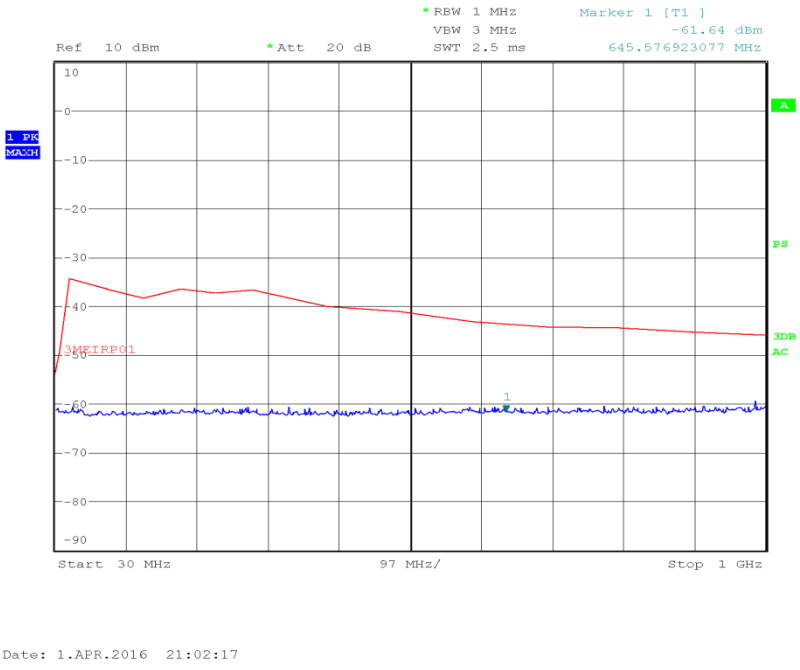
2.4.7 Test Results

PCS 1900, 1850.2 MHz, 30 MHz to 20 GHz, Emission Limitations for Broadband PCS Equipment Results

Frequency (MHz)	Emission Results (dBm)
*	

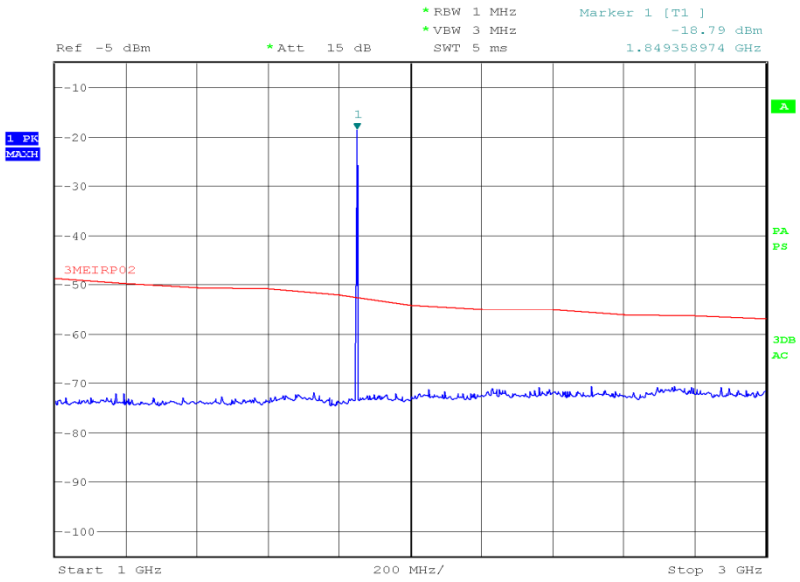
*No emissions were detected within 10 dB of the limit.

PCS 1900, 1850.2 MHz, 30 MHz to 1 GHz, Emission Limitations for Broadband PCS Equipment Results



Product Service

PCS 1900, 1850.2 MHz, 1 GHz to 3 GHz, Emission Limitations for Broadband PCS Equipment Plot



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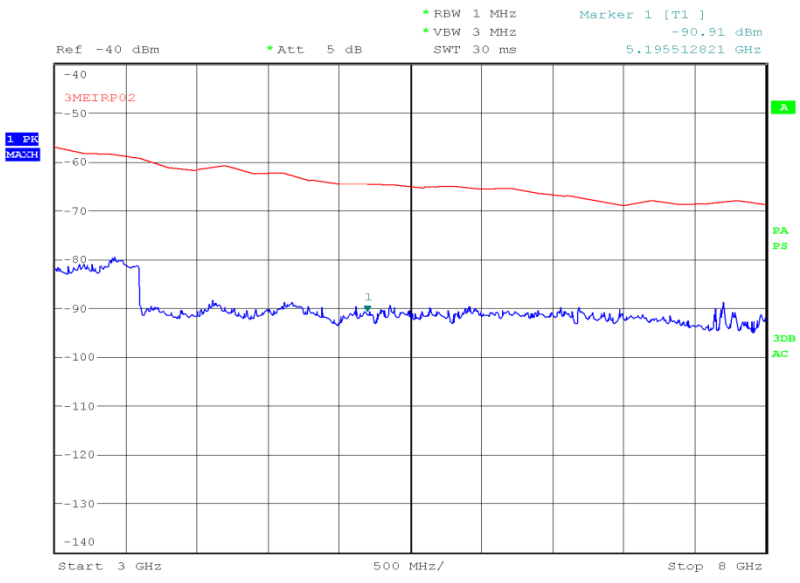
PCS 1900, 1850.2 MHz, 3 GHz to 8 GHz, Emission Limitations for Broadband PCS Equipment Plot



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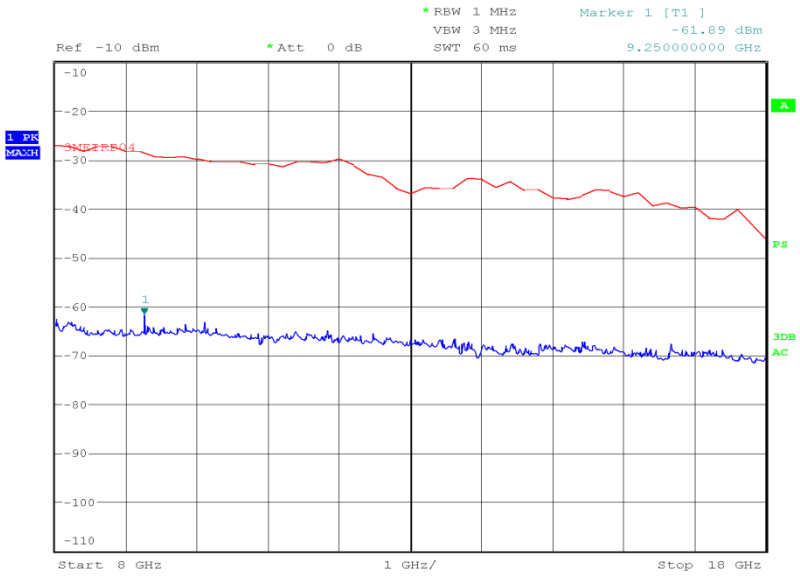
PCS 1900, 1850.2 MHz, 8 GHz to 18 GHz, Emission Limitations for Broadband PCS Equipment Plot



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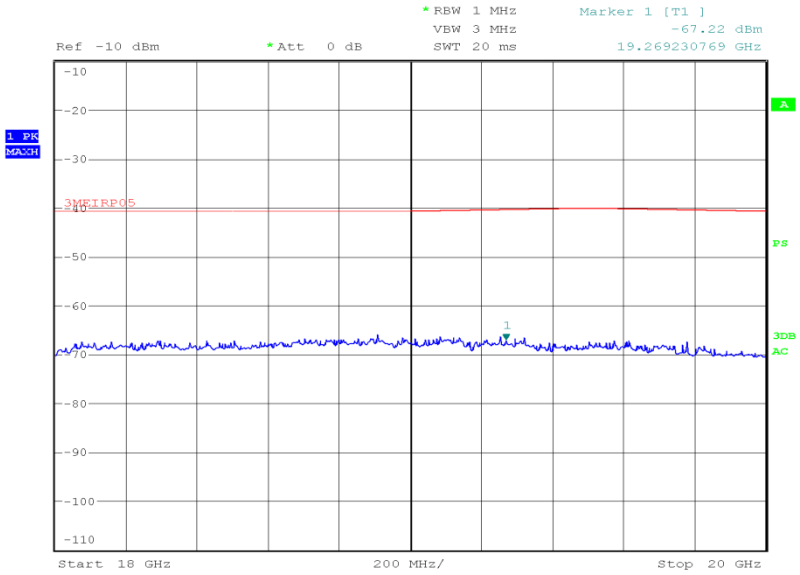
PCS 1900, 1850.2 MHz, 18 GHz to 20 GHz, Emission Limitations for Broadband PCS Equipment Plot



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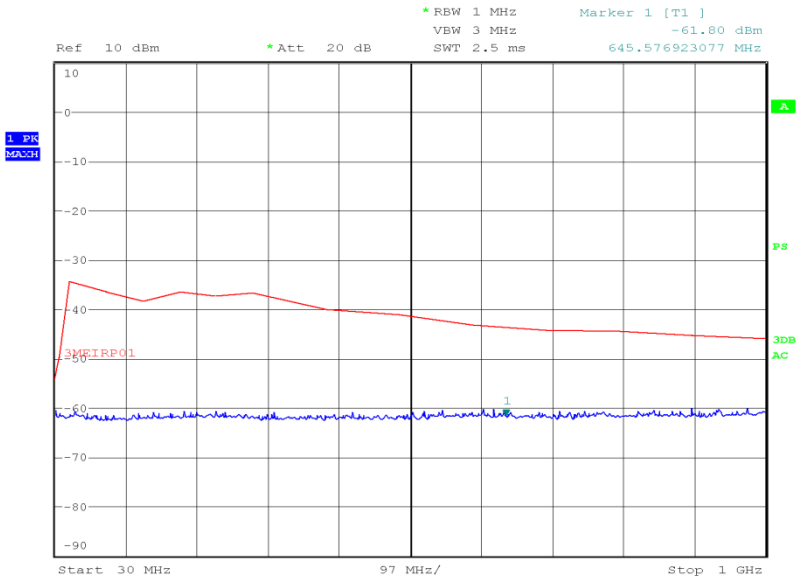
PCS 1900, 1880.0 MHz, 30 MHz to 1 GHz, Emission Limitations for Broadband PCS Equipment Results



Date: 1.APR.2016 20:57:31

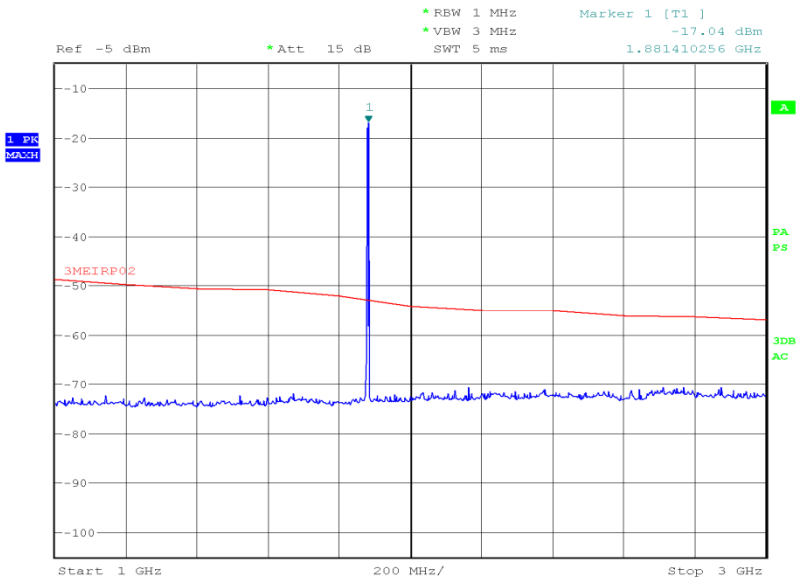
Product Service

PCS 1900, 1880.0 MHz, 1 GHz to 20 GHz, Emission Limitations for Broadband PCS Equipment Results

Frequency (MHz)	Emission Results (dBm)
*	

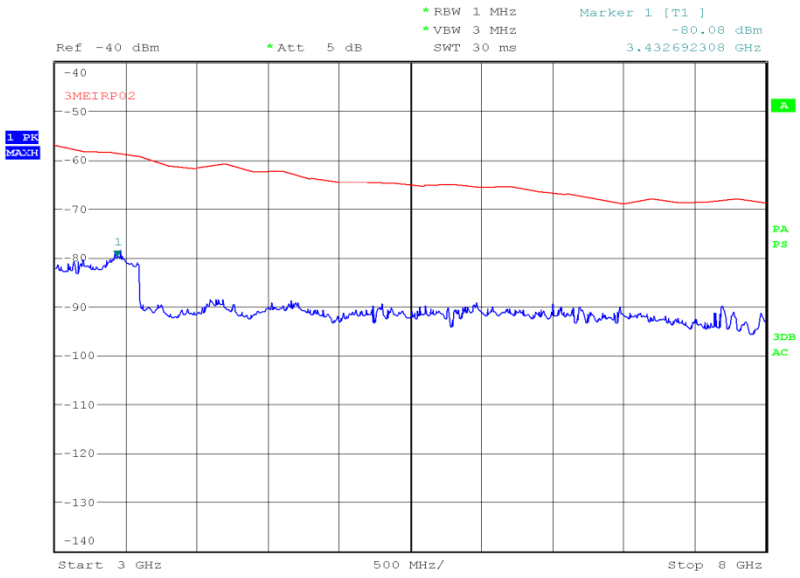
*No emissions were detected within 10 dB of the limit.

PCS 1900, 1880.0 MHz, 1 GHz to 3 GHz, Emission Limitations for Broadband PCS Equipment Plot



Product Service

PCS 1900, 1880.0 MHz, 3 GHz to 8 GHz, Emission Limitations for Broadband PCS Equipment Plot



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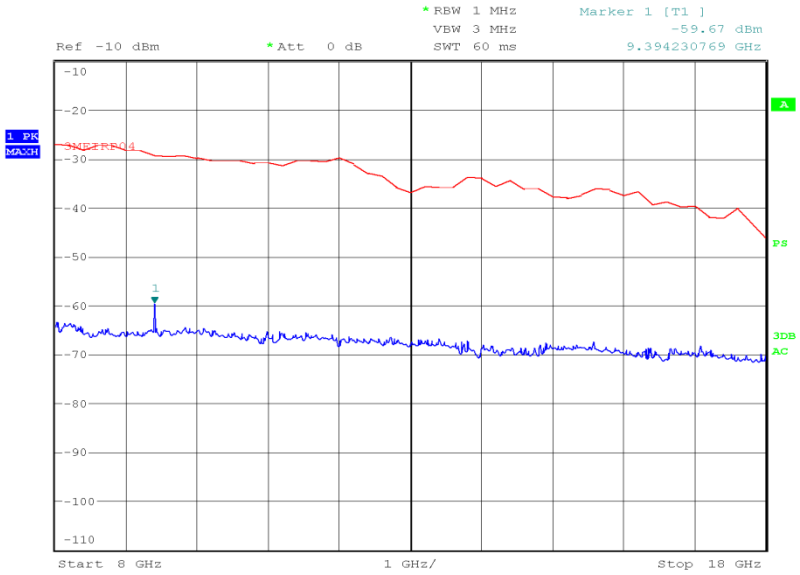
PCS 1900, 1880.0 MHz, 8 GHz to 18 GHz, Emission Limitations for Broadband PCS Equipment Plot



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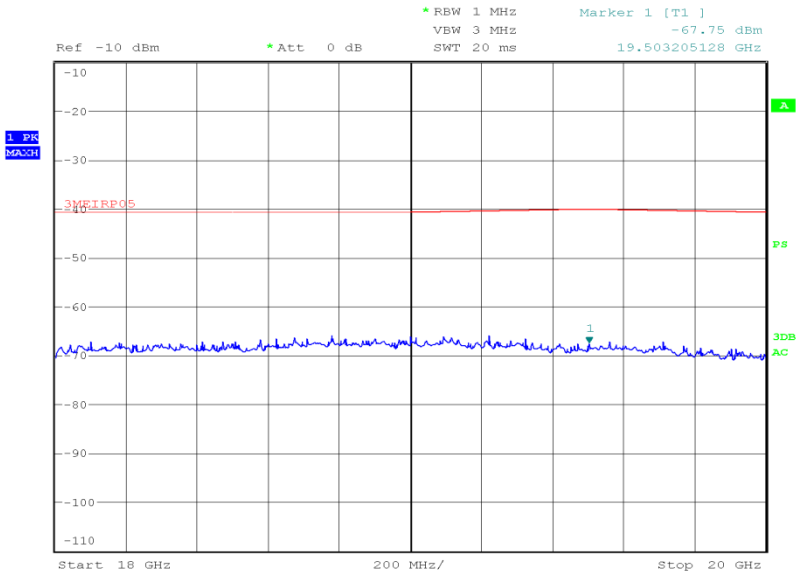
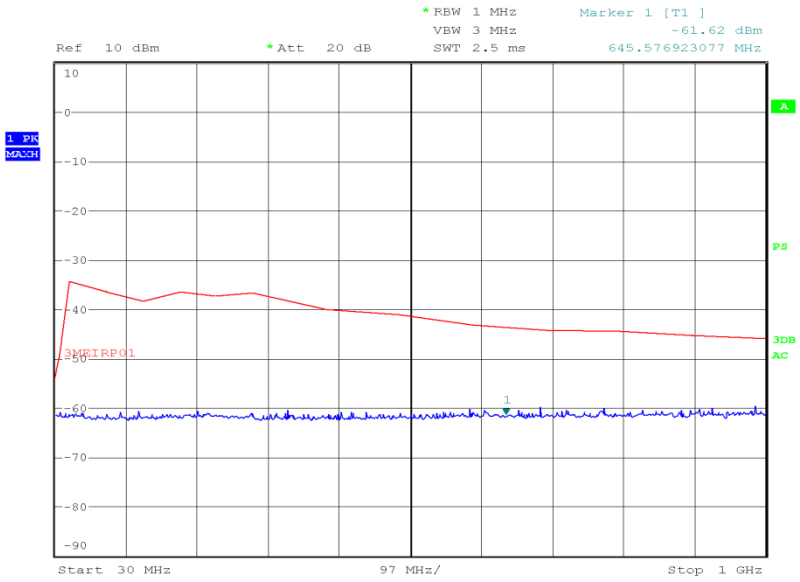
PCS 1900, 1880.0 MHz, 18 GHz to 20 GHz, Emission Limitations for Broadband PCS Equipment Plot



Date: 3.APR.2016 04:18:15

PCS 1900, 1909.8 MHz, 30 MHz to 1 GHz, Emission Limitations for Broadband PCS Equipment Results



Date: 1.APR.2016 21:07:10

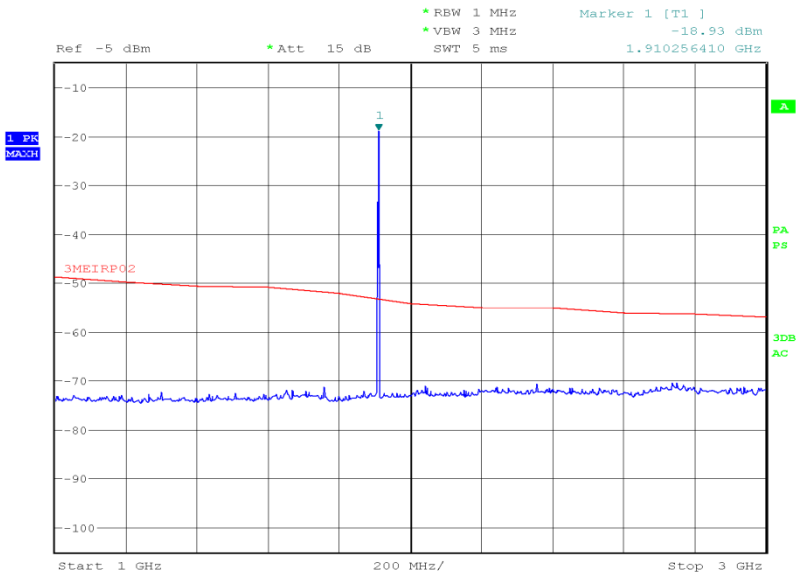
Product Service

PCS 1900, 1909.8 MHz, 1 GHz to 20 GHz, Emission Limitations for Broadband PCS Equipment Results

Frequency (MHz)	Emission Results (dBm)
*	

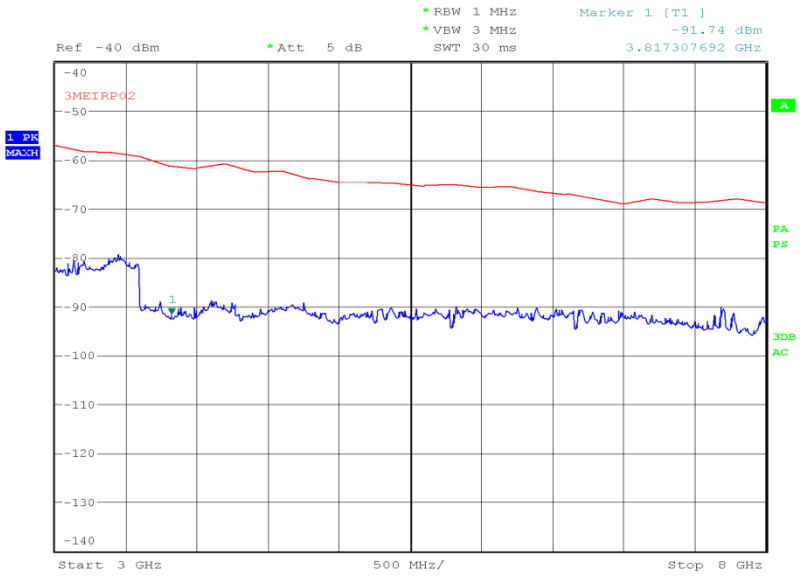
*No emissions were detected within 10 dB of the limit.

PCS 1900, 1909.8 MHz, 1 GHz to 3 GHz, Emission Limitations for Broadband PCS Equipment Plot



Product Service

PCS 1900, 1909.8 MHz, 3 GHz to 8 GHz, Emission Limitations for Broadband PCS Equipment Plot



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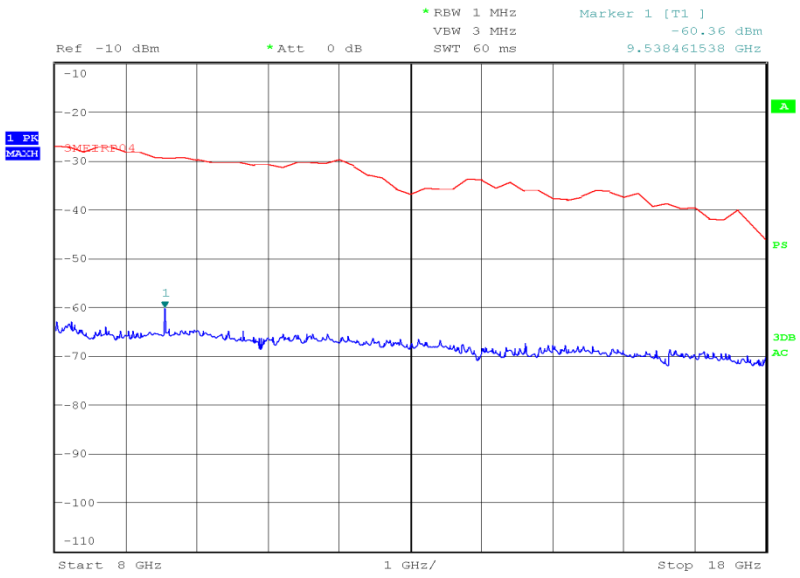
PCS 1900, 1909.8 MHz, 8 GHz to 18 GHz, Emission Limitations for Broadband PCS Equipment Plot



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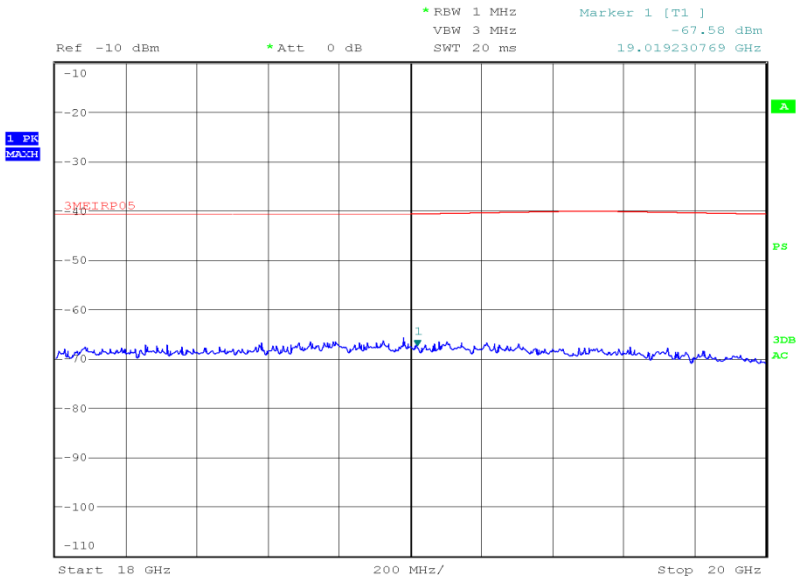
PCS 1900, 1909.8 MHz, 18 GHz to 20 GHz, Emission Limitations for Broadband PCS Equipment Plot



FCC 47 CFR Part 24, Limit Clause 24.238 (a)

43 + 10 log (P) dB or -13 dBm.

2.5 26 dB BANDWIDTH

2.5.1 Specification Reference

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

2.5.2 Equipment Under Test and Modification State

S/N: IMEI 004401115723286 - Modification State 0

2.5.3 Date of Test

1 April 2016

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

The test was performed in accordance with KDB 971168 D01 v02r02, Clause 4.1.

2.5.6 Environmental Conditions

Ambient Temperature	21.0°C
Relative Humidity	33.6%

Product Service

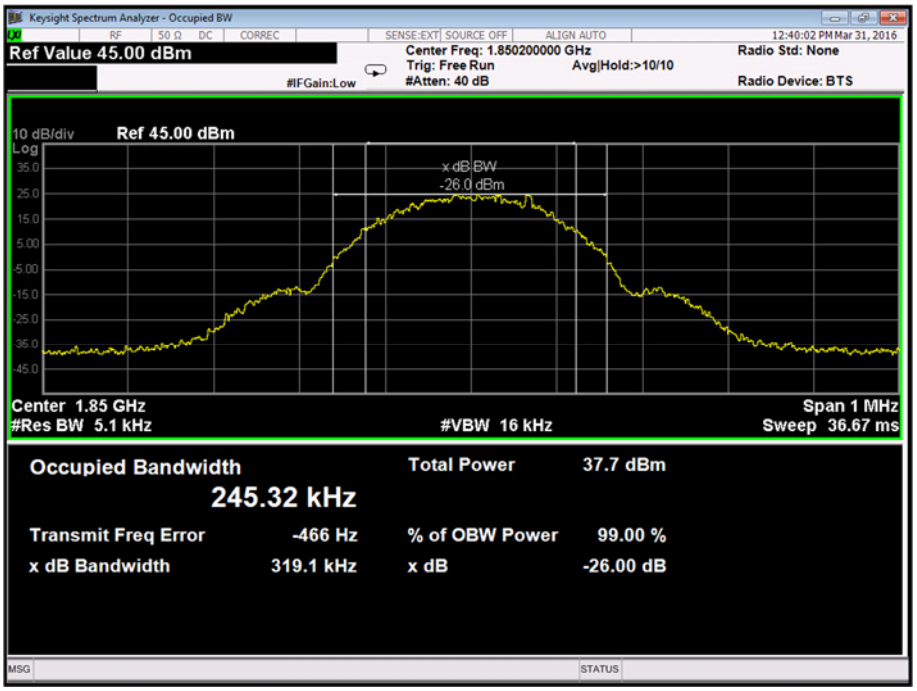
2.5.7 Test Results

4.0 V DC Supply

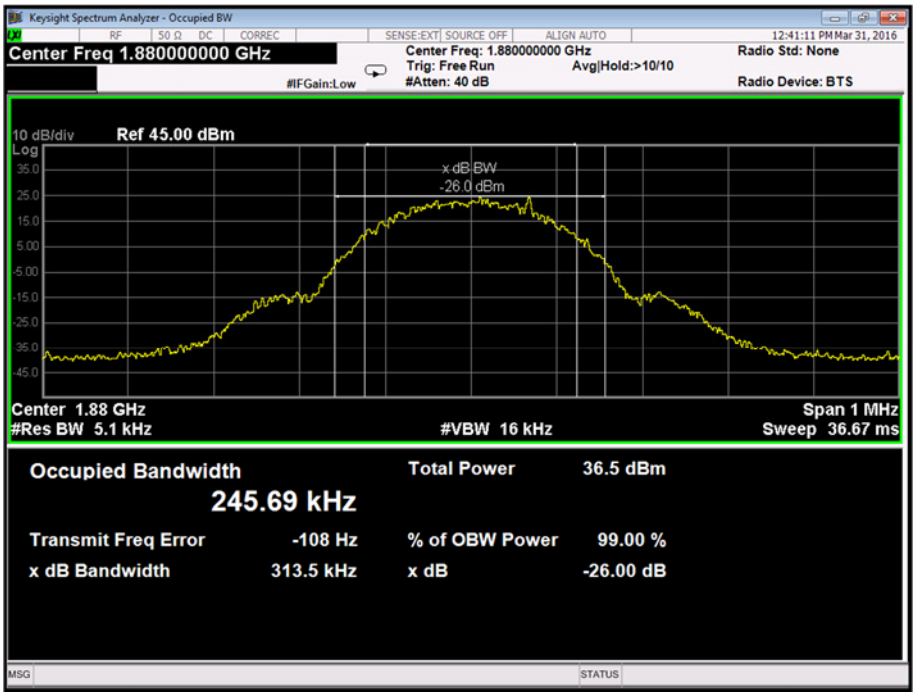
PCS 1900, Circuit-Switched (Voice), 26 dB Bandwidth Results

1850.2 MHz	1880.0 MHz	1909.8 MHz
kHz	kHz	kHz
319.1	313.5	315.2

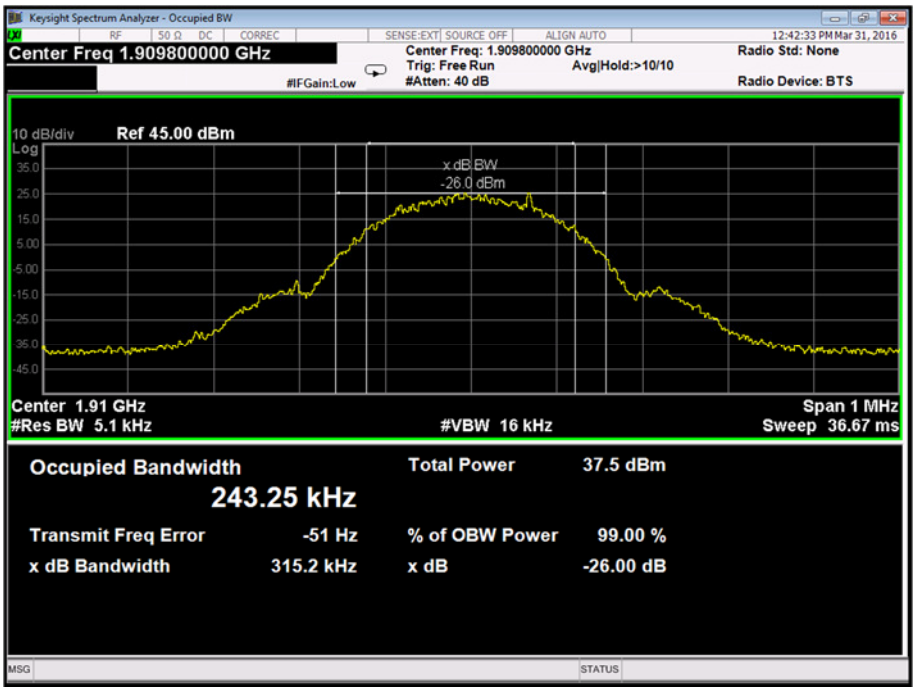
PCS 1900, 1850.2 MHz, Circuit-Switched (Voice), 26 dB Bandwidth Plot



PCS 1900, 1880.0 MHz, Circuit-Switched (Voice), 26 dB Bandwidth Plot



PCS 1900, 1909.8 MHz, Circuit-Switched (Voice), 26 dB Bandwidth Plot



FCC 47 CFR Part 24, Limit Clause 24.238

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.

2.6 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

2.6.1 Specification Reference

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

2.6.2 Equipment Under Test and Modification State

S/N: IMEI 004401115723286 - Modification State 0

2.6.3 Date of Test

31 March 2016

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

The test was performed in accordance with KDB 971168 D01 v02r02, Clause 6.

2.6.6 Environmental Conditions

Ambient Temperature	21.0°C
Relative Humidity	33.6%

Product Service

2.6.7 Test Results

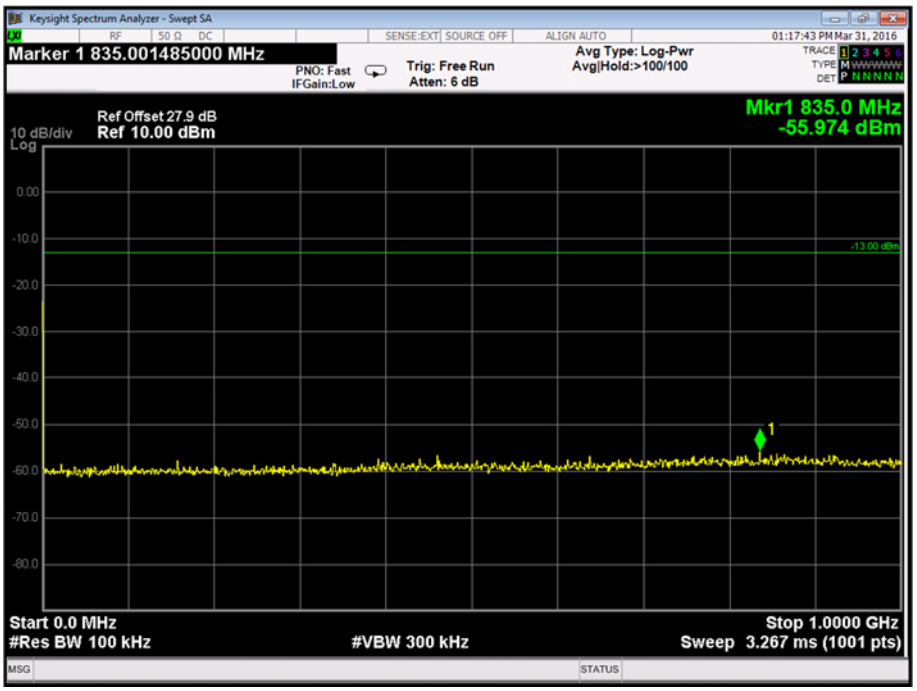
4.0 V DC Supply

PCS 1900, 1850.2 MHz, Spurious Emissions at Antenna Terminals Results

Frequency (MHz)	Emission Results (dBm)
*	

*No emissions were detected within 10 dB of the limit.

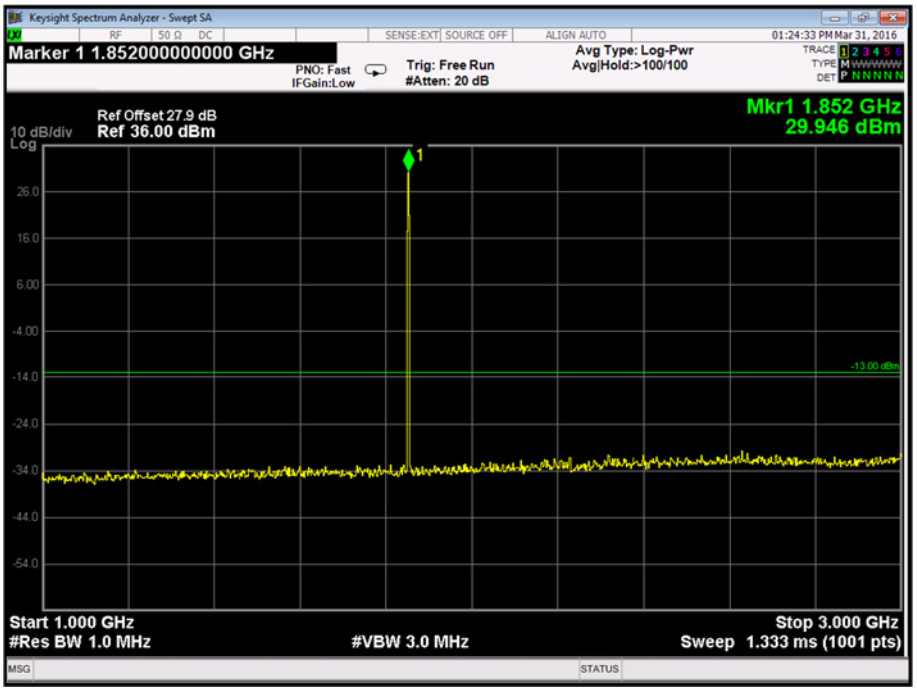
PCS 1900, 1850.2 MHz, 9 kHz to 1 GHz, Spurious Emissions at Antenna Terminals Plot



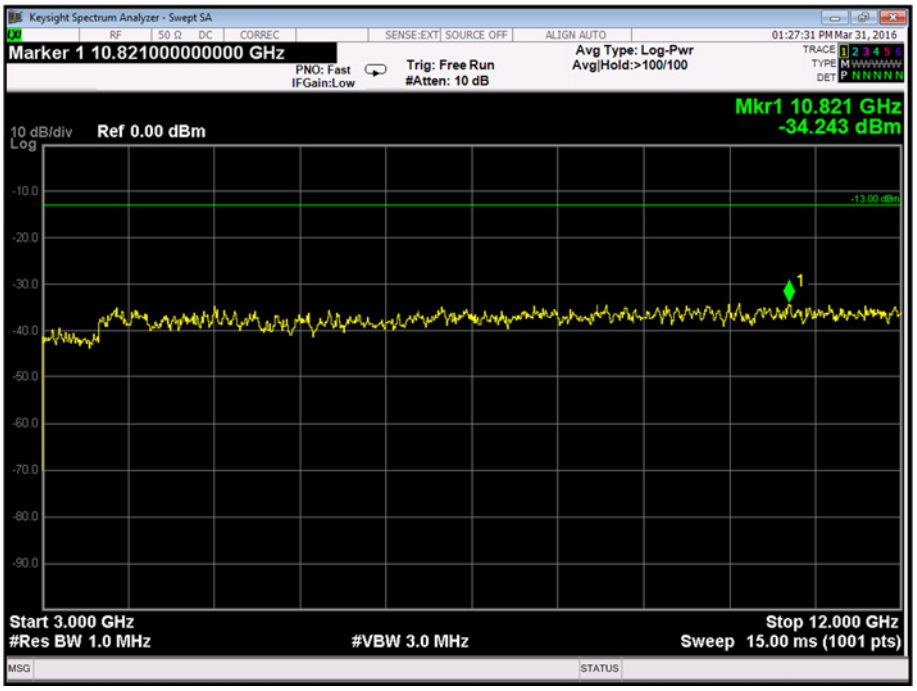
Note: For 9 kHz to 1 GHz frequency range, the limit line is to be reduced to -23 dBm. A correction factor of 10 log (1000/100) was applied as only a 100 kHz bandwidth was used.

Product Service

PCS 1900, 1850.2 MHz, 1 GHz to 3 GHz, Spurious Emissions at Antenna Terminals Plot

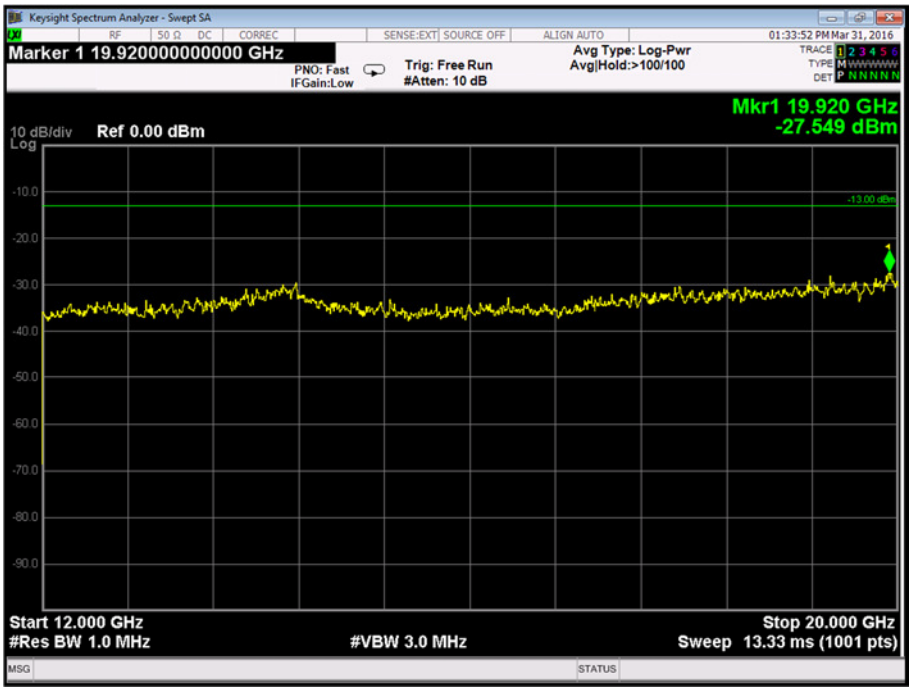


PCS 1900, 1850.2 MHz, 3 GHz to 12 GHz, Spurious Emissions at Antenna Terminals Plot



Product Service

PCS 1900, 1850.2 MHz, 12 GHz to 20 GHz, Spurious Emissions at Antenna Terminals Plot



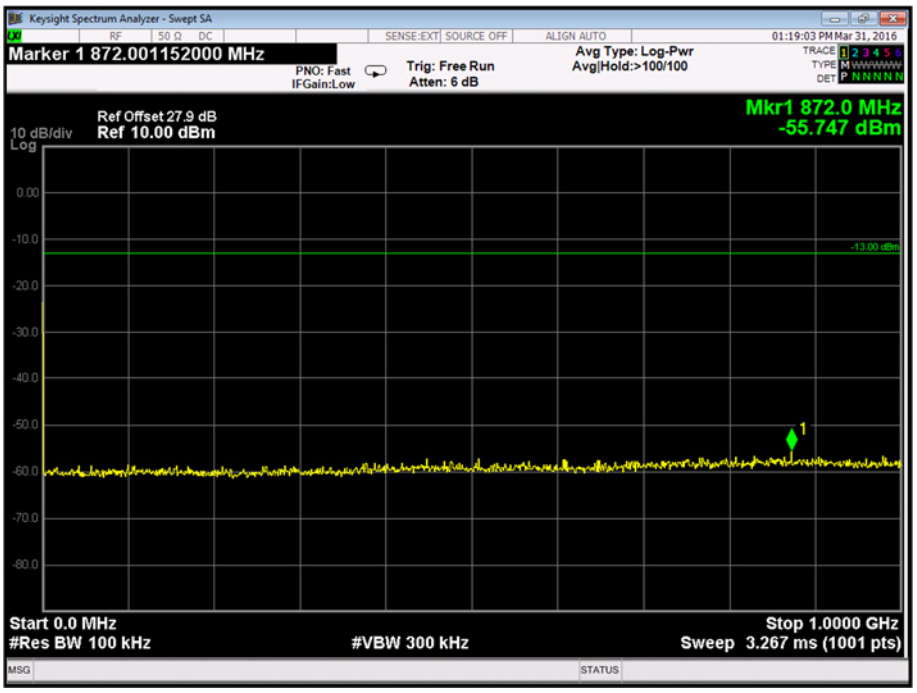
Product Service

PCS 1900, 1880.0 MHz, Spurious Emissions at Antenna Terminals Results

Frequency (MHz)	Emission Results (dBm)
*	

*No emissions were detected within 10 dB of the limit.

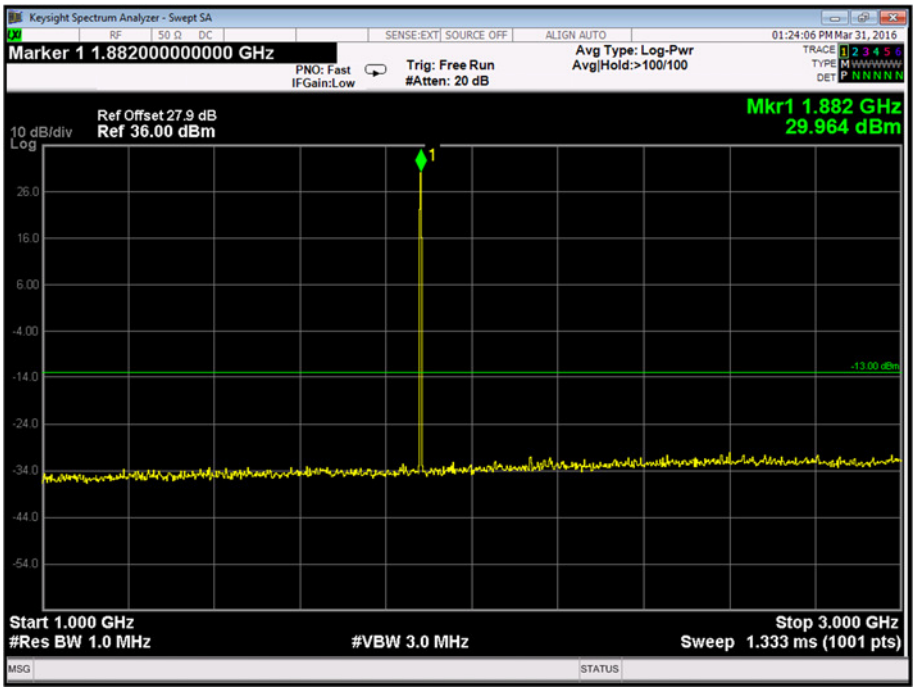
PCS 1900, 1880.0 MHz, 9 kHz to 1 GHz, Spurious Emissions at Antenna Terminals Plot



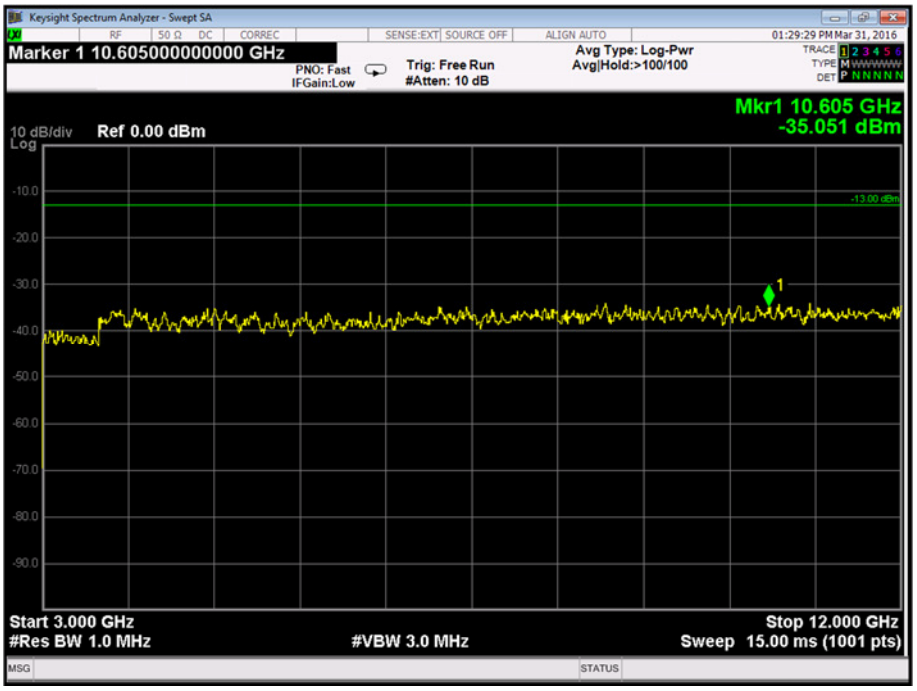
Note: For 9 kHz to 1 GHz frequency range, the limit line is to be reduced to -23 dBm. A correction factor of 10 log (1000/100) was applied as only a 100 kHz bandwidth was used.

Product Service

PCS 1900, 1880.0 MHz, 1 GHz to 3 GHz, Spurious Emissions at Antenna Terminals Plot

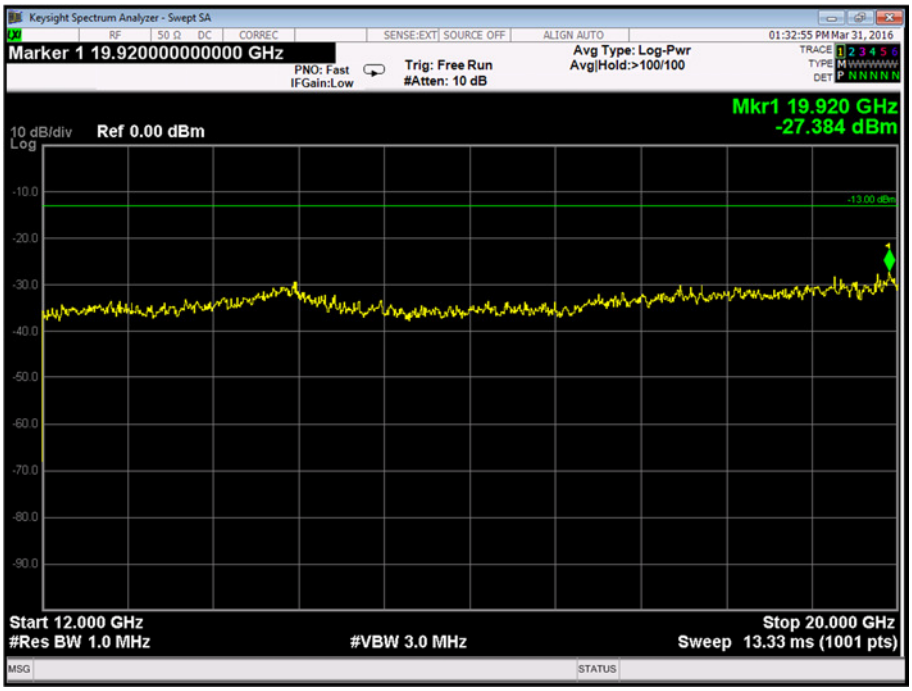


PCS 1900, 1880.0 MHz, 3 GHz to 12 GHz, Spurious Emissions at Antenna Terminals Plot



Product Service

PCS 1900, 1880.0 MHz, 12 GHz to 20 GHz, Spurious Emissions at Antenna Terminals Plot



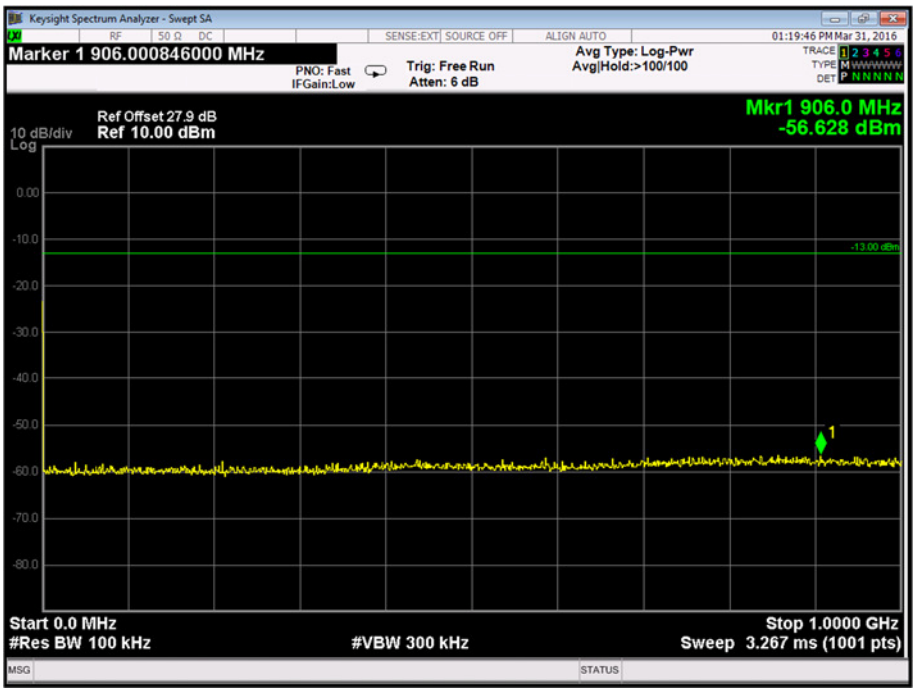
Product Service

PCS 1900, 1909.8 MHz, Spurious Emissions at Antenna Terminals Results

Frequency (MHz)	Emission Results (dBm)
*	

*No emissions were detected within 10 dB of the limit.

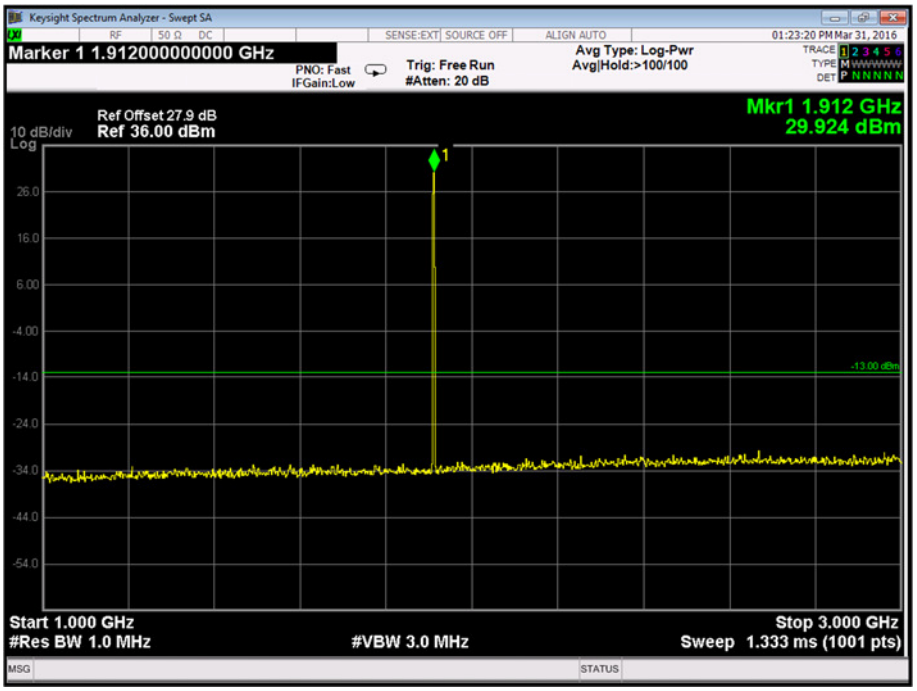
PCS 1900, 1909.8 MHz, 9 kHz to 1 GHz, Spurious Emissions at Antenna Terminals Plot



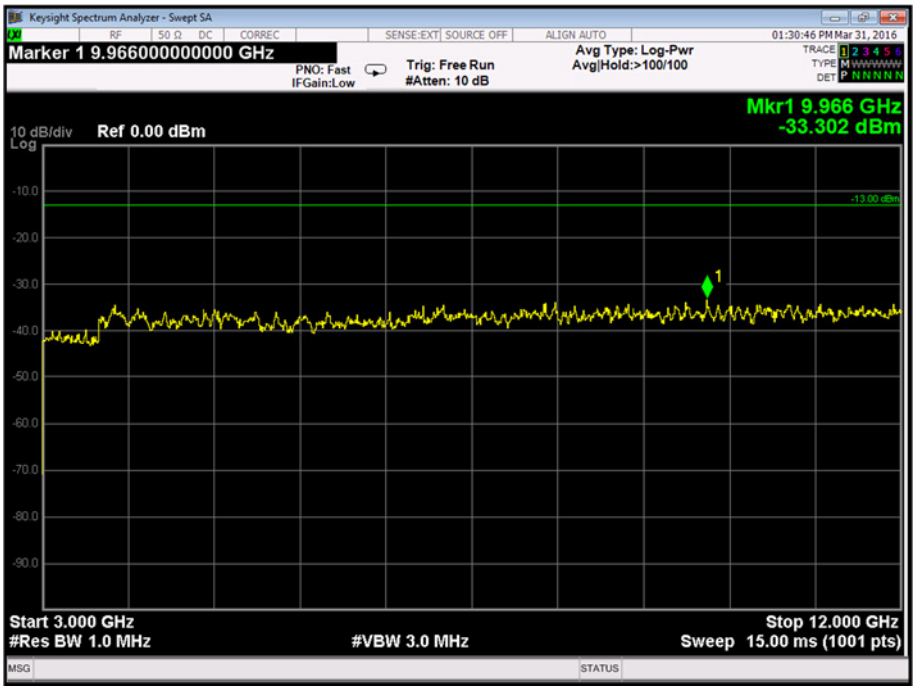
Note: For 9 kHz to 1 GHz frequency range, the limit line is to be reduced to -23 dBm. A correction factor of 10 log (1000/100) was applied as only a 100 kHz bandwidth was used.

Product Service

PCS 1900, 1909.8 MHz, 1 GHz to 3 GHz, Spurious Emissions at Antenna Terminals Plot

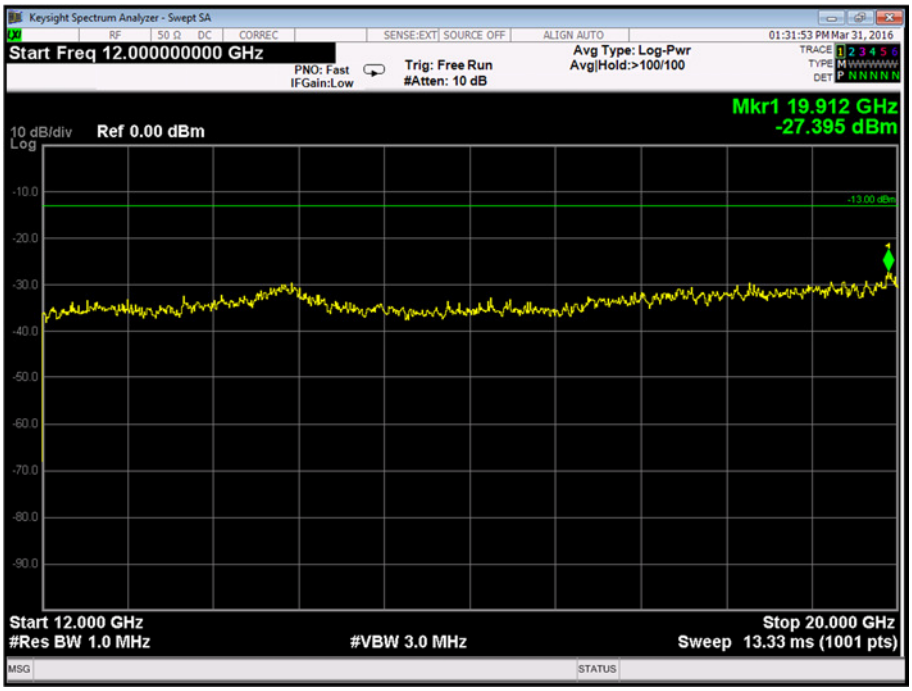


PCS 1900, 1909.8 MHz, 3 GHz to 12 GHz, Spurious Emissions at Antenna Terminals Plot



Product Service

PCS 1900, 1909.8 MHz, 12 GHz to 20 GHz, Spurious Emissions at Antenna Terminals Plot



FCC 47 CFR Part 24, Limit Clause 24.238 (a)

43 + 10 log (P) dB or -13 dBm.

Product Service

2.7 MODULATION CHARACTERISTICS

2.7.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1047 (d)

2.7.2 Test Results

PCS 1900, Modulation Characteristics, 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

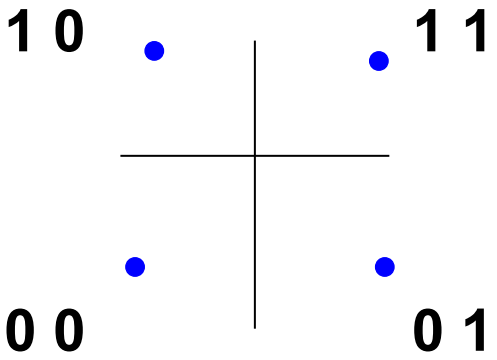
GMSK OVERVIEW

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)

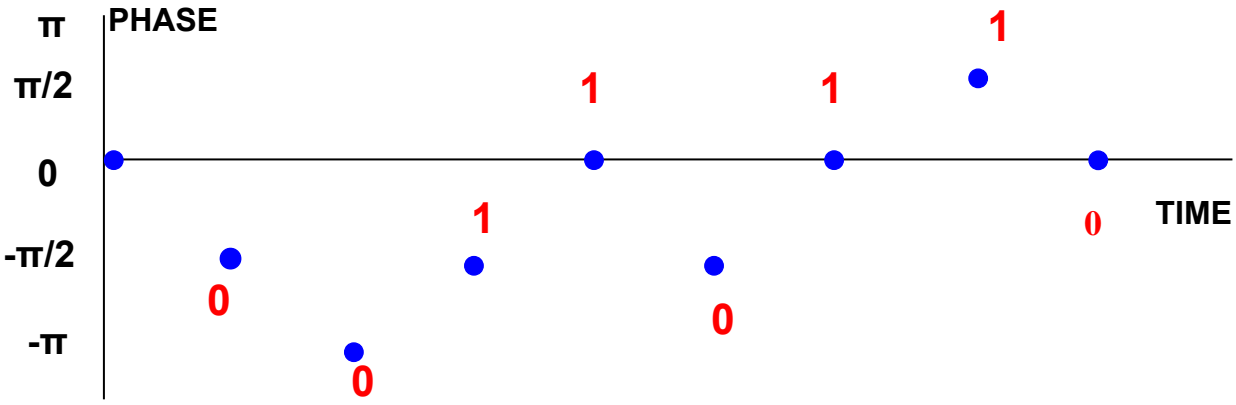
I Stream	0		1		0		1	
	-π/2		-π/2		-π/2		π/2	
Q stream		0		1		1		0
		-π/2		π/2		π/2		-π/2

Product Service

3. Combine (add) the two PSK signals:

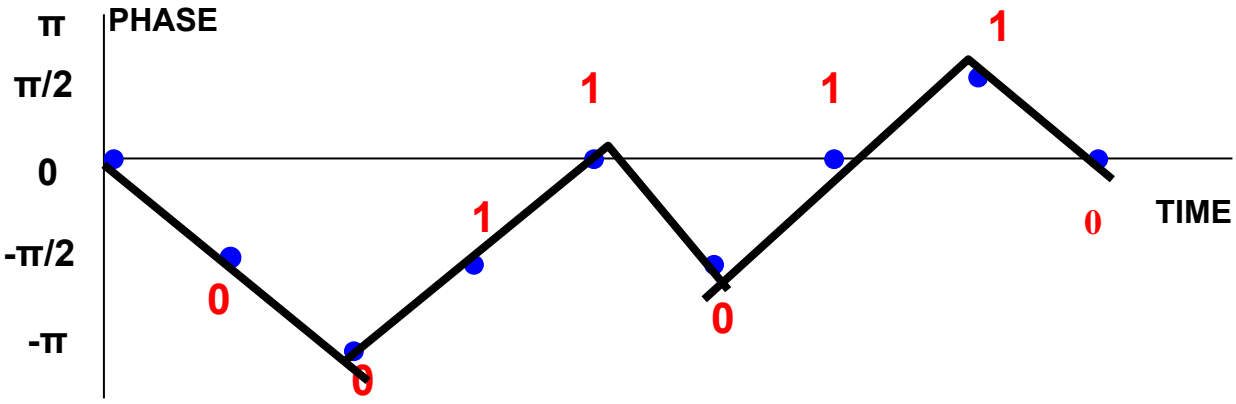
Combined Phase	-π/2	-π	-π/2	0	-π/2	0	π/2	0

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.

FCC 47 CFR Part 2, Limit Clause 2.1047 (d)

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

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 - Spurious Emissions at Band Edge					
Radio Communications Test Set	Rohde & Schwarz	CMU 200	39	12	10-Dec-2016
Multimeter	Fluke	75 Mk3	455	12	10-Sep-2016
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	30-Oct-2016
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	3-Sep-2016
Power Supply	Iso-tech	IPS 2010	2439	-	O/P Mon
Filter	Daden Anthony Ass	MH-1500-7SS	2778	12	5-Feb-2017
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
Combiner/Splitter	Weinschel	1506A	3878	12	2-Jun-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	3-Sep-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4511	12	2-Mar-2017
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4512	12	29-Jan-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	8-Oct-2016
Section 2.2 - Maximum Conducted Output Power					
Radio Communications Test Set	Rohde & Schwarz	CMU 200	442	12	18-Jan-2017
Multimeter	Fluke	75 Mk3	455	12	10-Sep-2016
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	30-Oct-2016
Power Supply	Iso-tech	IPS 2010	2439	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
Combiner/Splitter	Weinschel	1506A	3878	12	2-Jun-2016
P-Series Power Meter	Agilent Technologies	N1911A	3981	12	25-Sep-2016
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3983	12	25-Sep-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4511	12	2-Mar-2017
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4512	12	29-Jan-2017
Section 2.3 - Frequency Stability					
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Attenuator 10dB/25W	Weinschel	46-10-43	400	12	18-Jun-2016
Power Supply Unit	Hewlett Packard	6253A	441	-	O/P Mon
Hygrometer	Rotronic	I-1000	2882	12	4-Nov-2016
Thermocouple Thermometer	Fluke	51	3174	12	9-Dec-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	4143	12	2-Sep-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016

Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.4 - Emission Limitations for Broadband PCS Equipment					
Dual Power Supply Unit	Thurlby	PL320	288	-	TU
Antenna 18-40GHz (Double Ridge Guide)	Q-Par Angus Ltd	QSH 180K	1511	24	27-Nov-2016
Pre-Amplifier	Phase One	PS04-0086	1533	12	30-Jul-2016
18GHz - 40GHz Pre-Amplifier	Phase One	PSO4-0087	1534	12	23-Dec-2016
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	11-Jun-2017
Radio Communications Test Set	Rohde & Schwarz	CMU 200	3035	12	16-Nov-2016
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	28-Sep-2016
High Pass Filter (3GHz)	RLC Electronics	F-100-3000-5-R	3349	12	28-May-2016
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	2-Nov-2016
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	29-Dec-2016
Section 2.5 - 26 dB Bandwidth					
Radio Communications Test Set	Rohde & Schwarz	CMU 200	39	12	10-Dec-2016
Multimeter	Fluke	75 Mk3	455	12	10-Sep-2016
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	30-Oct-2016
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	3-Sep-2016
Power Supply	Iso-tech	IPS 2010	2439	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
Combiner/Splitter	Weinschel	1506A	3878	12	2-Jun-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	3-Sep-2016
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4511	12	2-Mar-2017
1 metre SMA Cable	Florida Labs	SMS-235SP-39.4-SMS	4512	12	29-Jan-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	8-Oct-2016
1 metre SMA Cable	IW Microwave	3PS-1806LC-394-3PS	4662	12	6-Nov-2016
Section 2.6 - Spurious Emissions at Antenna Terminals					
Radio Communications Test Set	Rohde & Schwarz	CMU 200	39	12	10-Dec-2016
Multimeter	Fluke	75 Mk3	455	12	10-Sep-2016
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	30-Oct-2016
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	3-Sep-2016
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	2-Nov-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
Combiner/Splitter	Weinschel	1506A	3878	12	2-Jun-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	3-Sep-2016
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4411	12	23-Mar-2017
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	8-Oct-2016

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 Conducted Output Power	± 0.70 dB
26 dB Bandwidth	± 9.37 kHz
Spurious Emissions at Antenna Terminals	± 3.454 dB
Modulation Characteristics	-
Spurious Emissions at Band Edge	± 9.37 kHz
Emission Limitations for Broadband PCS Equipment	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 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).