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Report On

FCC Testing of the Sharp CDMA SHI11
Tri Band CDMA (BC0/BC3, BC6) Cellular Phone with Bluetooth, WLAN
& FeliCa and GPS
In accordance with FCC CFR 47 Part 15C (Bluetooth)

COMMERCIAL-IN-CONFIDENCE

FCC ID: APYHRO00149

Document 75913699 Report 07 Issue 1

June 2011



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COMMERCIAL-IN-CONFIDENCE

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Document 75913699 Report 07 Issue 1

June 2011

PREPARED FOR

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PREPARED BY

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APPROVED BY

M Jenkins
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DATED

11 June 2011

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 15C. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

S Bennett

G Lawler





CONTENTS

Section	Page No
1	REPORT SUMMARY 3
1.1	Introduction 4
1.2	Brief Summary of Results 5
1.3	Application Form 6
1.4	Product Information 7
1.5	Test Conditions 8
1.6	Deviations From the Standard 8
1.7	Modification Record 8
2	TEST DETAILS 9
2.1	20dB Bandwidth 10
2.2	Channel Separation 18
2.3	Channel Dwell Time 20
2.4	Number of Hopping Channels 27
2.5	Radiated Emissions (Enclosure Port) 29
2.6	Maximum Peak Conducted Output Power 39
2.7	EIRP Peak Power 41
2.8	Spurious Emissions 45
2.9	Band Edge Emissions 47
3	TEST EQUIPMENT USED 50
3.1	Test Equipment Used 51
3.2	Measurement Uncertainty 53
4	ACCREDITATION, DISCLAIMERS AND COPYRIGHT 54
4.1	Accreditation, Disclaimers and Copyright 55



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SECTION 1

REPORT SUMMARY

FCC Testing of the Sharp CDMA SHI11
Tri Band CDMA (BC0/BC3, BC6) Cellular Phone with Bluetooth, WLAN & FeliCa and GPS
In accordance with FCC CFR 47 Part 15C (Bluetooth)



1.1 INTRODUCTION

The information contained in this report is intended to show verification of Sharp CDMA SH11 Tri Band CDMA (BC0/BC3, BC6) Cellular Phone with Bluetooth, WLAN & FeliCa and GPS to the requirements of FCC CFR 47 Part 15C.

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
Manufacturing Description	Tri Band CDMA (BC0/BC3, BC6) Cellular Phone with Bluetooth, WLAN & FeliCa and GPS
Model Number(s)	CDMA SH11
Serial Number(s)	SSHFA001007 SSHFA001005 SSHFA001004
Software Version	A4010
Hardware Version	PP1
Number of Samples Tested	Three
Test Specification/Issue/Date	FCC CFR 47 Part 15C: 2010
Incoming Release Date	Application Form 2011
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	8528 10 May 2011
Start of Test	06 May 2011
Finish of Test	10 June 2011
Name of Engineer(s)	S Bennett G Lawler R Henley
Related Document(s)	ANSI C63.4: 2003



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results for each configuration, in accordance with FCC CFR 47 Part 15C is shown below.

Configuration 1: Bluetooth with EDR						
Section	Spec Clause	Test Description	Mode	Mod State	Result	Base Standard
2.1	15.247 (a)(1)	20dB Bandwidth	2402 MHz Tx	0	Pass	ANSI C63.4
			2441 MHz Tx	0	Pass	
			2480 MHz Tx	0	Pass	
2.2	15.247 (a)(1)	Channel Separation	2402 MHz Tx	0	Pass	ANSI C63.4
			2441 MHz Tx	0	Pass	
			2480 MHz Tx	0	Pass	
2.3	15.247 (a)(1)(iii)	Channel Dwell Time	2402 MHz Tx	-	N/A	ANSI C63.4
			2441 MHz Tx	0	Pass	
			2480 MHz Tx	-	N/A	
2.4	15.247 (a)(1)(iii)	Number of Hopping Channels	2402 MHz Tx	0	Pass	ANSI C63.4
			2441 MHz Tx	0	Pass	
			2480 MHz Tx	0	Pass	
2.5	15.247(a)(2)	Radiated Emissions (Enclosure Port)	2402 MHz Tx	0	Pass	ANSI C63.4
			2441 MHz Tx	0	Pass	
			2480 MHz Tx	0	Pass	
2.6	15.247 (b)(3)	Maximum Peak Conducted Output Power	2402 MHz Tx	0	Pass	ANSI C63.4
			2441 MHz Tx	0	Pass	
			2480 MHz Tx	0	Pass	
2.7	15.247 (b)(4)	EIRP Peak Power	2402 MHz Tx	0	Pass	ANSI C63.4
			2441 MHz Tx	0	Pass	
			2480 MHz Tx	0	Pass	
2.8	15.247(d)	Spurious Emissions	2402 MHz Tx	0	Pass	ANSI C63.4
			2441 MHz Tx	0	Pass	
			2480 MHz Tx	0	Pass	
2.9	15.247(d)	Band Edge Emissions	2402 MHz Tx	0	Pass	ANSI C63.4
			2441 MHz Tx	-	N/A	
			2480 MHz Tx	0	Pass	

N/A – Not Applicable



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1.3 APPLICATION FORM

APPLICANT'S DETAILS	
COMPANY NAME :	Sharp Telecommunications of Europe Ltd
ADDRESS :	Azure House, Bagshot Road Bracknell, Berkshire RG12 7QY
NAME FOR CONTACT PURPOSES :	Ken Newman
TELEPHONE NO: 01344 301 883	FAX NO: 01344 300 293 E-MAIL: ken.newman@sharp.eu

EQUIPMENT INFORMATION	
<u>Equipment designator:</u>	
Model name/number	CDMA SHI11
Identification number	APYHRO00149
<u>Supply Voltage:</u>	
☐ AC mains	State AC voltage V and AC frequency Hz
☐ DC (external)	State DC voltage V and DC current A
☒ DC (internal)	State DC voltage 3.7 V and Battery type Li-ion
<u>Frequency characteristics:</u>	
Frequency range	2402 MHz to 2480 MHz
Channel spacing	1MHz (if channelized)
Designated test frequencies:	
Bottom: 2402 MHz	Middle: 2440 MHz
	Top: 2480 MHz
<u>Power characteristics:</u>	
Maximum transmitter power	6 dBm
Minimum transmitter power	 W (if variable)
☒ Continuous transmission	
☐ Intermittent transmission	State duty cycle
If intermittent, can transmitter be set to continuous transmit test mode? Y/N	
<u>Antenna characteristics:</u>	
☐ Antenna connector	State impedance ohm
☒ Temporary antenna connector	State impedance 50 ohm
☐ Integral antenna	State gain 2.14 dBi
<u>Modulation characteristics:</u>	
☐ Amplitude	☐ Other
☒ Frequency	Details:
☒ Phase	
Can the transmitter operate un-modulated?	N
ITU Class of emission:	
<u>Extreme conditions:</u>	
Maximum temperature	+60 °C
Minimum temperature	-20 °C
Maximum supply voltage	4.0 V
Minimum supply voltage	3.7 V



Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp CDMA SHI11 Tri Band CDMA (BC0/BC3, BC6) Cellular Phone with Bluetooth, WLAN & FeliCa and GPS. A full technical description can be found in the manufacturer's documentation.

1.4.2 Test Configuration

Configuration 1: Bluetooth with EDR

The EUT was configured in accordance with FCC CFR 47 Part 15C.

1.4.3 Modes of Operation

Modes of operation of each EUT during testing were as follows:

Mode 1 – 2402 MHz Tx

Mode 2 – 2441 MHz Tx

Mode 3 – 2480 MHz Tx

Mode 4 – Hopping on all channels

Information on the specific test modes utilised are detailed in the test procedure for each individual test.



Product Service

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 or test laboratories as appropriate.

The EUT was powered from a 3.7 V DC Supply.

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

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

1.7 MODIFICATION RECORD

No modifications were made to the EUT during testing.



Product Service

SECTION 2

TEST DETAILS

FCC Testing of the Sharp CDMA SHI11
Tri Band CDMA (BC0/BC3, BC6) Cellular Phone with Bluetooth, WLAN & FeliCa and GPS In
accordance with FCC CFR 47 Part 15C (Bluetooth)



Product Service

2.1 20dB BANDWIDTH**2.1.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.247 (a)(1)

2.1.2 Equipment Under Test

CDMA SH111, S/N: SSHFA001007

2.1.3 Date of Test and Modification State

12 May 2011 - Modification State 0

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 Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.

The EUT was transmitted at maximum power via a cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen. The peak point of the trace was measured and the markers positioned to give the -6dBc points of the displayed spectrum.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.1.6 Environmental Conditions

	12 May 2011
Ambient Temperature	21.1°C
Relative Humidity	49.8%



Product Service

2.1.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 15C for 20dB Bandwidth.

The test results are shown below.

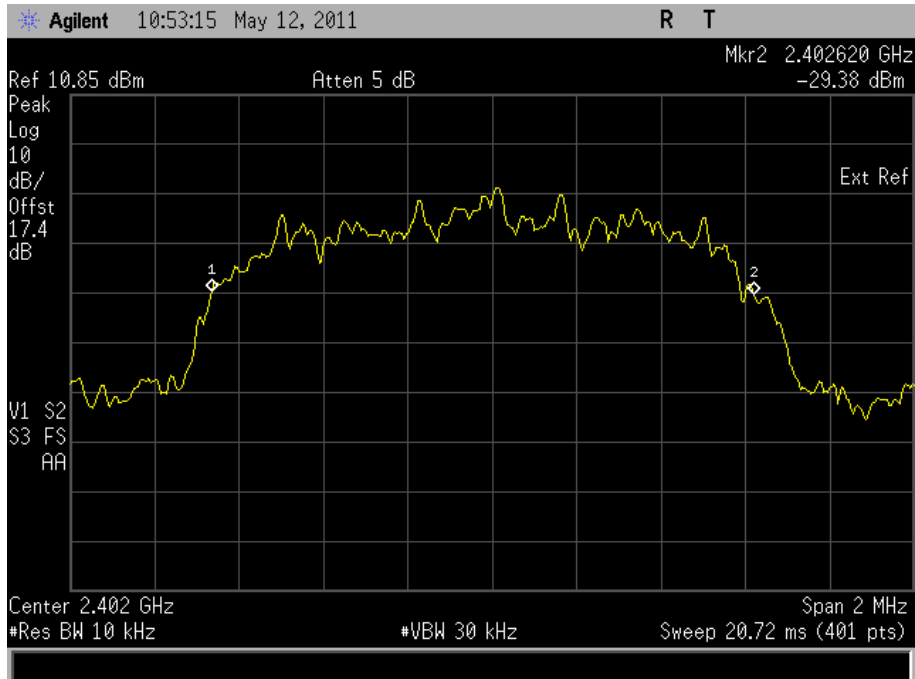
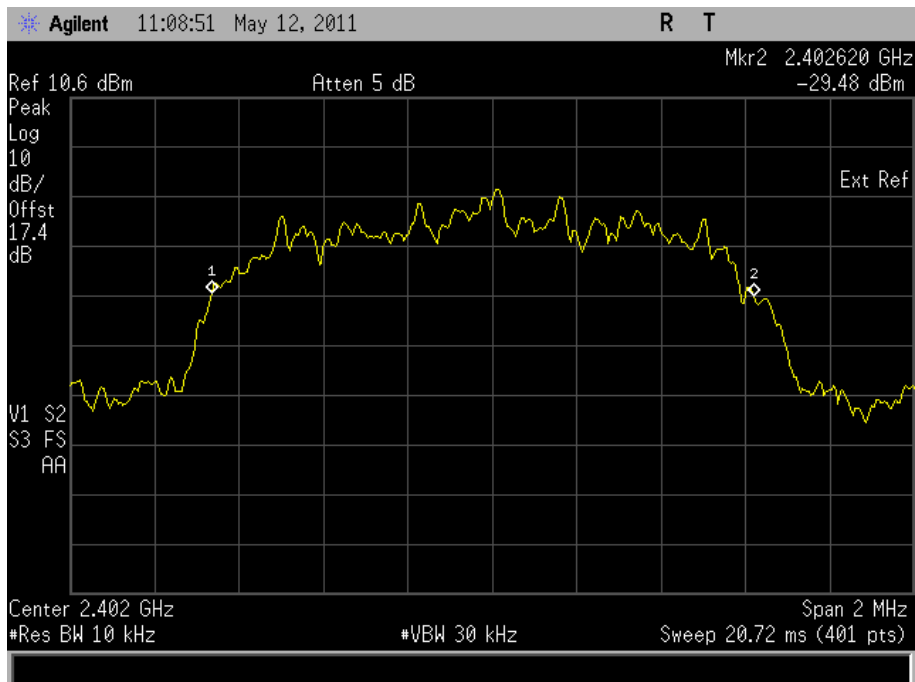
4.0 V DC Supply

Configuration 1 – Modes 1, 2 and 3

Frequency (MHz)	Data Rate (Mbps)	20dB Bandwidth (kHz)
2402	2DH1	1285
	2DH3	1285
	2DH5	1320
2441	2DH1	1290
	2DH3	1325
	2DH5	1320
2480	2DH1	1285
	2DH3	1325
	2DH5	1325



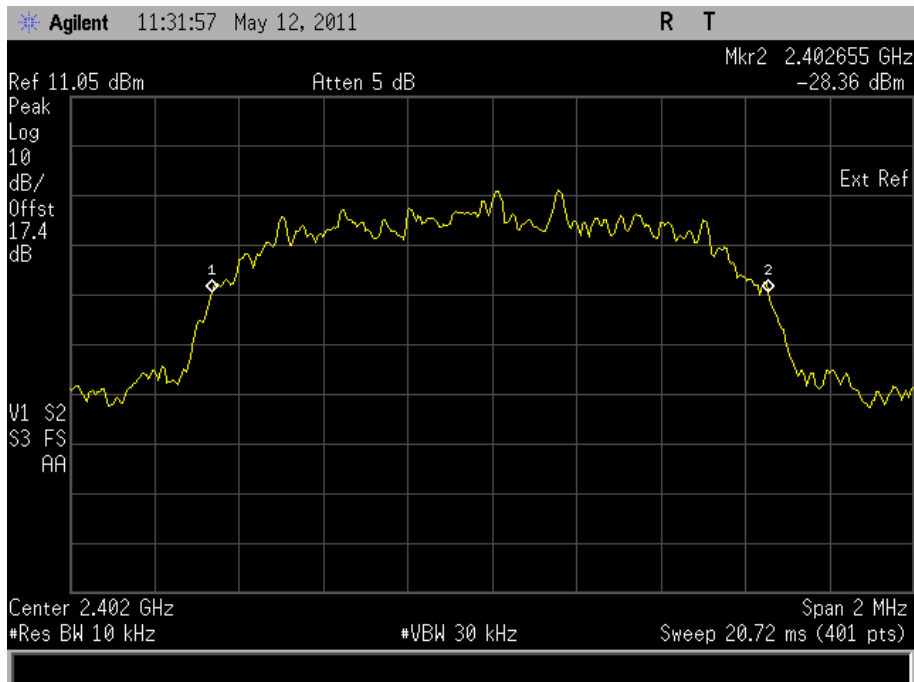
Product Service

2402 MHz2DH12DH3



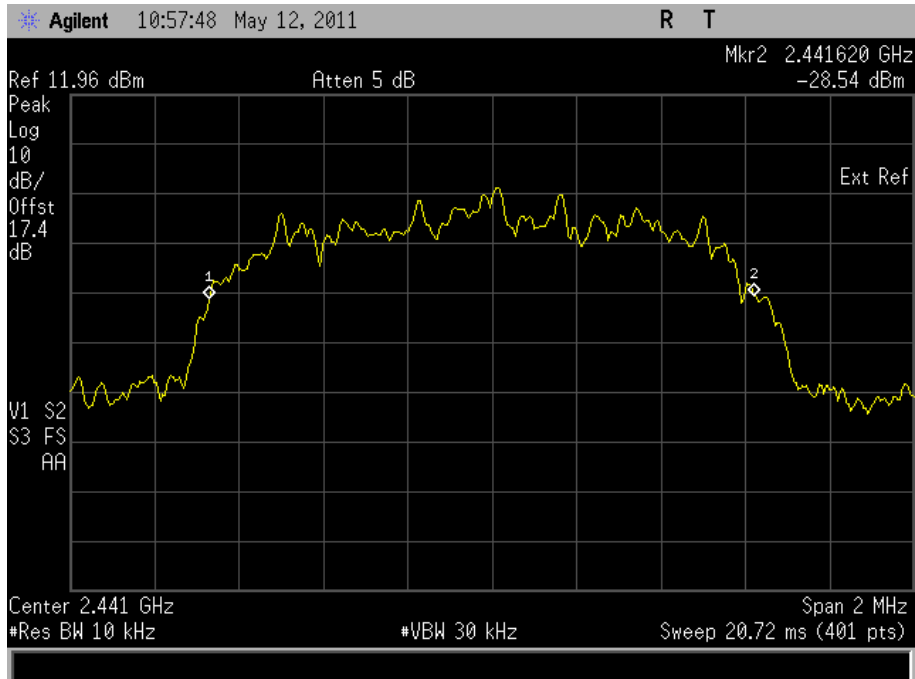
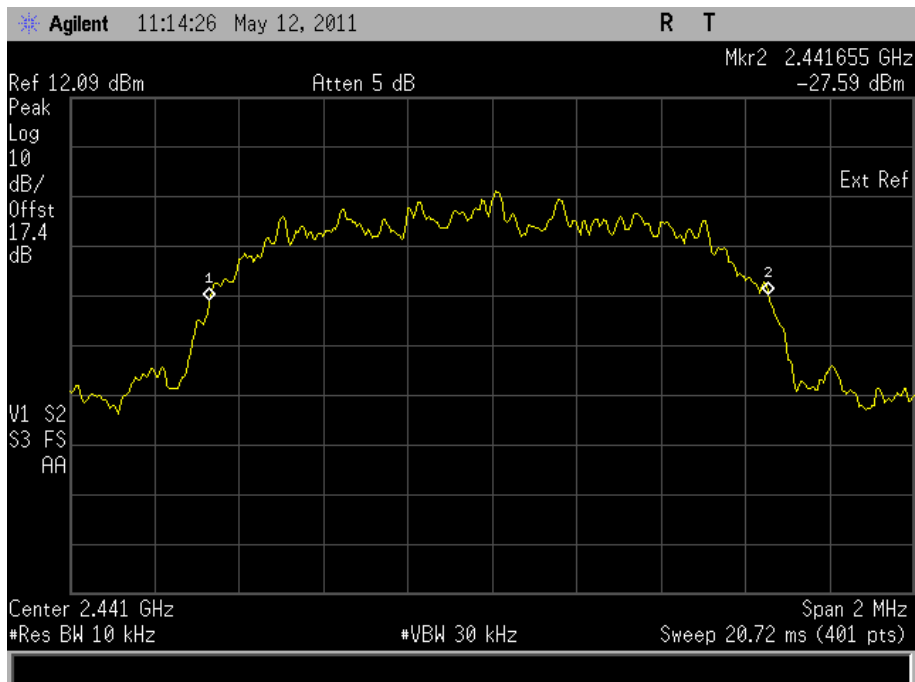
Product Service

2DH5





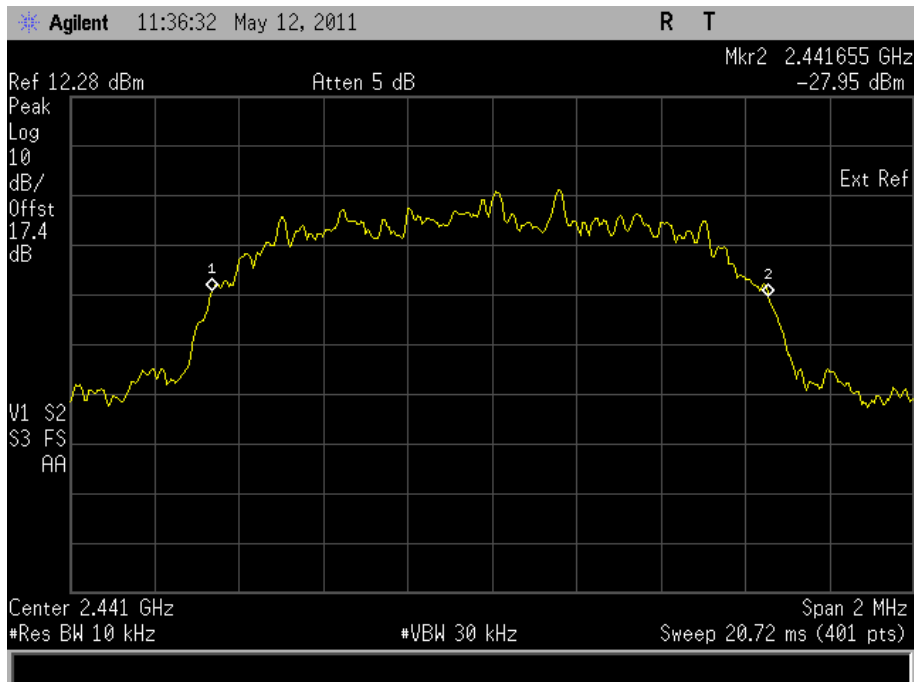
Product Service

2441 MHz2DH12DH3



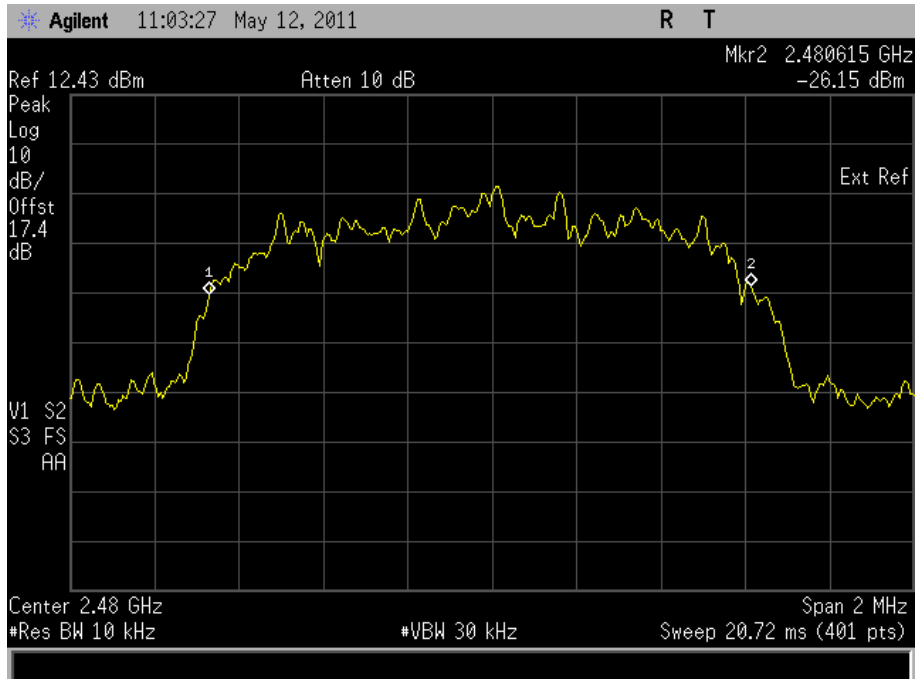
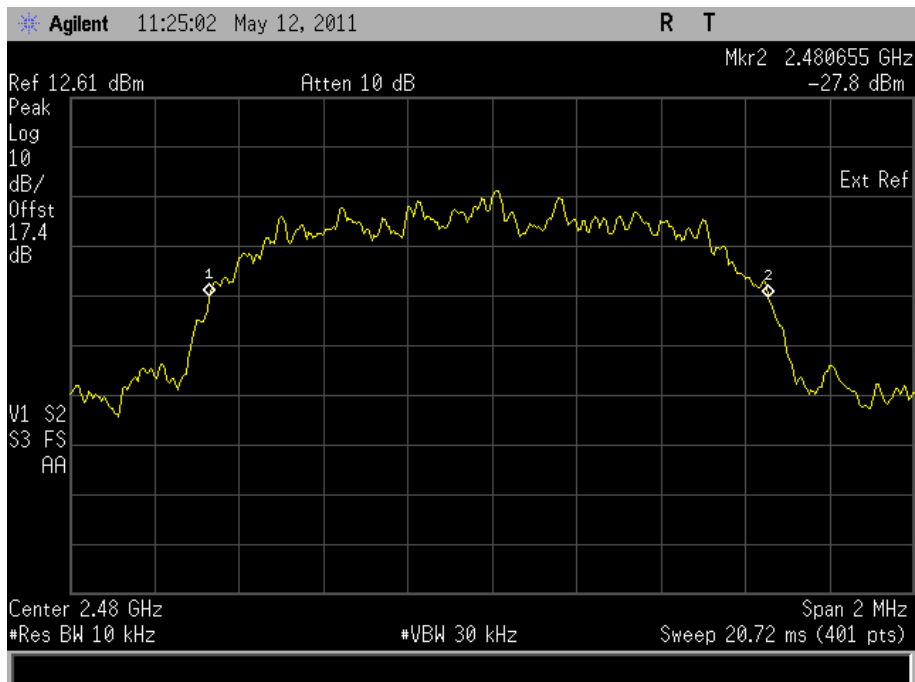
Product Service

2DH5



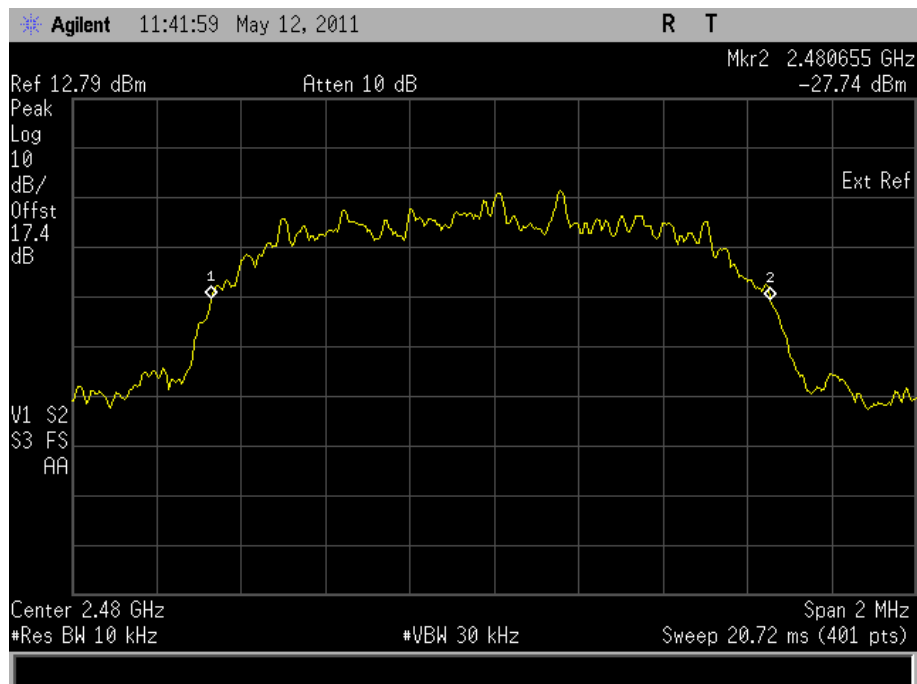


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2480 MHz2DH12DH3



Product Service

2DH5Limit Clause

The minimum 6 dB Bandwidth shall be at least 500 kHz.



Product Service

2.2 CHANNEL SEPARATION

2.2.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (a)(1)

2.2.2 Equipment Under Test

CDMA SH111, S/N: SSHFA001005

2.2.3 Date of Test and Modification State

06 May 2011 - Modification State 0

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 Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.

The EUT was transmitted at maximum power into a Spectrum Analyser. The trace was set to Max Hold to store several adjacent channels on screen. Using the marker delta function, the markers were positioned to show the separation between adjacent channels.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.2.6 Environmental Conditions

	06 May 2011
Ambient Temperature	24.1°C
Relative Humidity	34.2%



Product Service

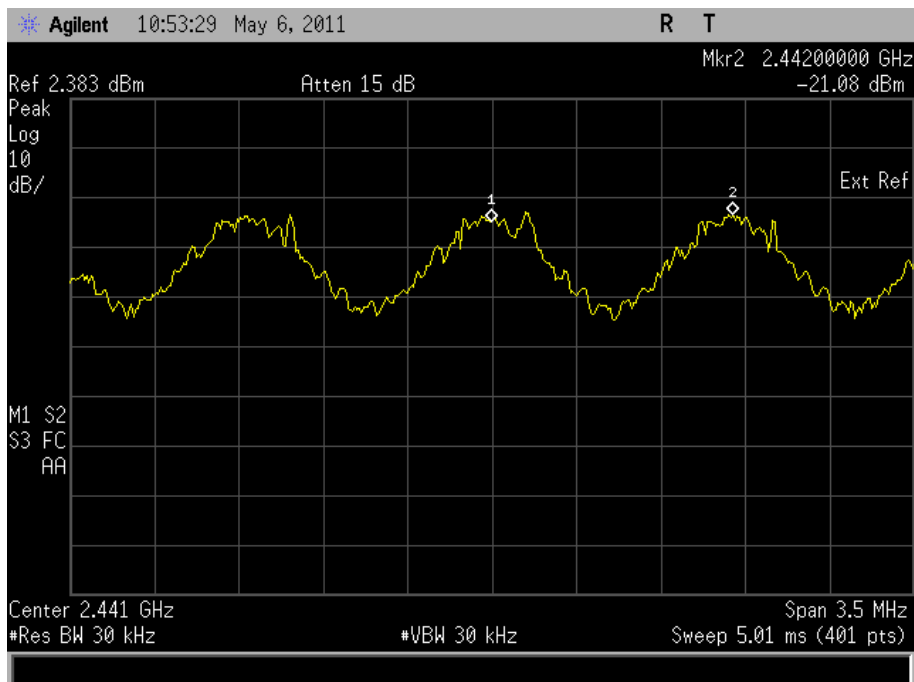
2.2.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 15C for Channel Separation.

The test results are shown below.

4.0 V DC Supply

Configuration 1 – Modes 1, 2 and 3



Limit Clause

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W.

The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.



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2.3 CHANNEL DWELL TIME

2.3.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (a)(1)(iii)

2.3.2 Equipment Under Test

CDMA SH111, S/N: SSHFA001005

2.3.3 Date of Test and Modification State

06 May 2011 - Modification State 0

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 Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15 .

DH1

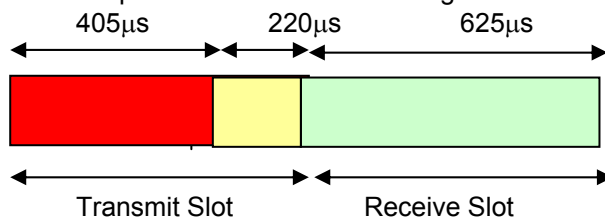
The Bluetooth system hops at a rate of 1600 times per second. Thus, this equates to 1600 timeslots in 1 second.

The DH1 data rate operates on a Transmit on 1 timeslot and Receive on 1 timeslot basis. Thus, in 1 second, there are 800 Transmit timeslots and 800 Receive timeslots.

Thus:

$$1 \text{ Timeslot} = \frac{1}{1600} = 625\mu\text{s}$$

In 1 transmit timeslot, the transmit on time is only 405 μs . 220 μs is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.





DH1 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle

So, with 800 Tx and 800 Rx timeslots, the transmitter is on for $800 \times 405\mu\text{s} = 0.324$ seconds.

$$\therefore \frac{\text{Total Tx Time On}}{\text{No of Channels}} = \frac{0.324}{80} = 4.05\text{ms}$$

So, in 32 seconds, the transmitter dwell time per channel is:

$$32 \times 4.05\text{ms} = 0.1296 \text{ seconds}$$

DH3

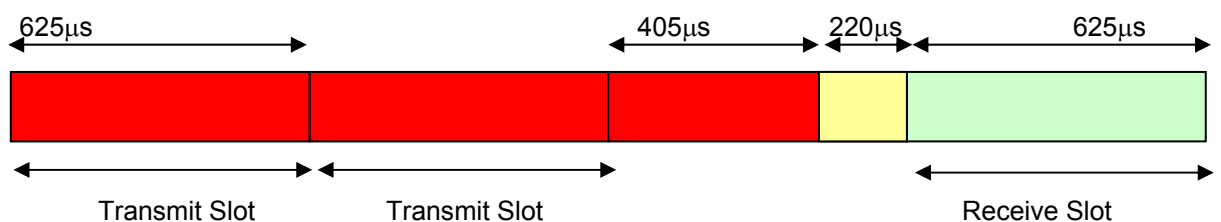
With data rate DH3, the data payload is higher and can use up to 3 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 3 slots, (ie. no receive slot in-between the 3 transmit slots). The $220\mu\text{s}$ off time for synthesizer re-tuning at the end of a slot is only used on the final slot. Thus, for one cycle, there are 3 transmit timeslots. 2 are $625\mu\text{s}$ long and the final slot is transmitting for $405\mu\text{s}$.

The DH3 data rate operates on a Transmit on 3 timeslots and Receives on 1 timeslot basis, (assuming maximum data payload). The frequency-hopping rate is the same. Thus, in 1 second, there are 1200 Transmit timeslots and 400 Receive timeslots.

Thus:

$$1 \text{ Timeslot} = \frac{1}{1600} = 625\mu\text{s}$$

The first 2 Transmit timeslots are transmitting for the complete $625\mu\text{s}$. In the third transmit slot, the transmit on time is only $405\mu\text{s}$. $220\mu\text{s}$ is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.





DH3 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle, (Maximum Payload)

Thus, the transmitter for one complete transmit and receive cycle would be on for:

$$\text{Tx} \quad (2 \times 625\mu\text{s}) + (1 \times 405\mu\text{s}) = 1.655\text{ms}$$

So:

$$\begin{aligned} 800 \times 625\mu\text{s} &= 0.5 \text{ seconds} \\ 400 \times 405\mu\text{s} &= 0.162 \text{ seconds} \end{aligned}$$

$$\text{Thus:} \quad 0.5 + 0.162 = 0.662 \text{ seconds}$$

$$\therefore \frac{\text{Total Tx Time On}}{\text{No Of Channels}} = \frac{0.662}{80} = 8.275\text{ms}$$

So, in 32 seconds, the transmitter dwell time per channel is:

$$32 \times 8.275\text{ms} = 0.2648 \text{ seconds}$$

DH5

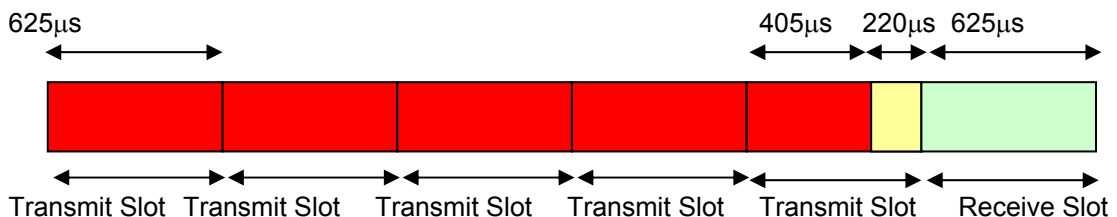
With data rate DH5, the data payload is higher and can use up to 5 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 5 slots, (ie. no receive slot in-between the 5 transmit slots). The 220 μ s off time for synthesizer re-tuning at the end of a slot is only used on the final slot. Thus, for one cycle, there are 5 transmit timeslots. 4 are 625 μ s long and the final slot is transmitting for 405 μ s.

The DH5 data rate operates on a Transmit on 5 timeslots and Receives on 1 timeslot basis, (assuming maximum data payload). The frequency-hopping rate is the same. Thus, in 1 second, there are 1333.3 Transmit timeslots and 266.7 Receive timeslots.

Thus:

$$1 \text{ Timeslot} = \frac{1}{1600} = 625\mu\text{s}$$

The first 4 Transmit timeslots are transmitting for the complete 625 μ s. In the fifth transmit slot, the transmit on time is only 405 μ s. 220 μ s is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.





DH5 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle, (Maximum Payload)

Thus, the transmitter for one complete transmit and receive cycle would be on for:

$$\text{Tx} \quad (2 \times 625\mu\text{s}) + (1 \times 405\mu\text{s}) \quad = \quad 2.905\text{ms}$$

So:

$$1066.7 \times 625\mu\text{s} \quad = \quad 0.666 \text{ seconds}$$

$$266.7 \times 405\mu\text{s} \quad = \quad 0.108 \text{ seconds}$$

$$\text{Thus:} \quad 0.666 + 0.108 = 0.774 \text{ seconds}$$

$$\therefore \quad \frac{\text{Total Tx Time On}}{\text{No Of Channels}} \quad = \quad \frac{0.774}{80} \quad = \quad 9.675\text{ms}$$

So, in 32 seconds, the transmitter dwell time per channel is:

$$32 \times 9.675\text{ms} = \quad 0.31 \text{ seconds}$$

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 2

2.3.6 Environmental Conditions

06 May2011

Ambient Temperature 24.1°C

Relative Humidity 34.2%



Product Service

2.3.7 Test Results

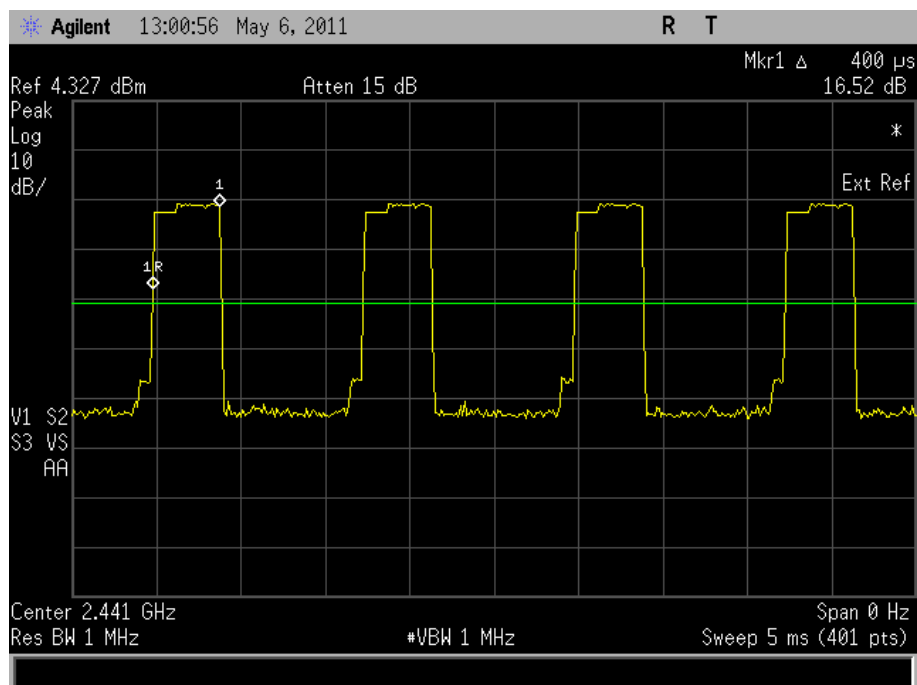
For the period of test the EUT met the requirements of FCC CFR 47 Part 15C for Channel Dwell Time.

The test results are shown below.

4.0 V DC Supply

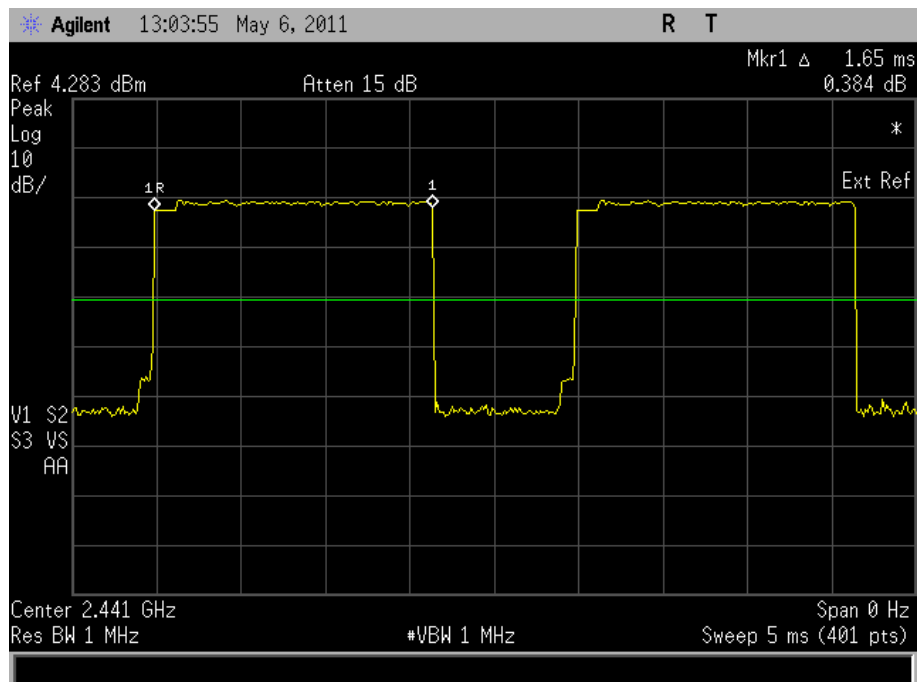
Configuration 1 - Mode 2

2DH1

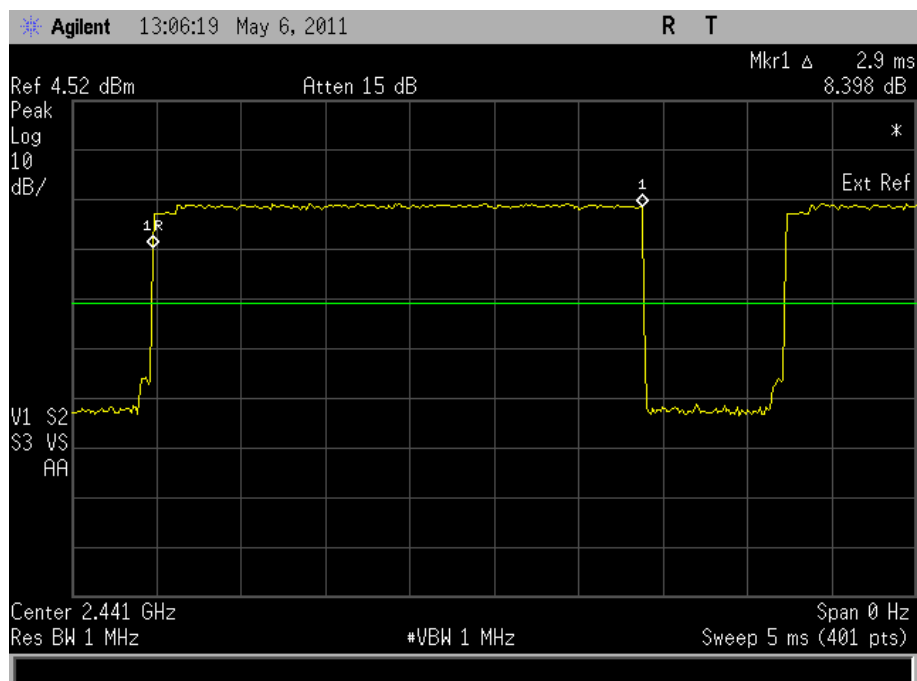




2DH3



2DH5





Product Service

Limit Clause

Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.



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2.4 NUMBER OF HOPPING CHANNELS**2.4.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.247 (a)(1)(iii)

2.4.2 Equipment Under Test

CDMA SH111, S/N: SSHFA001005

2.4.3 Date of Test and Modification State

06 May 2011 - Modification State 0

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 Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.

The EUT was connected to a Spectrum Analyser via a cable. The EUT was set to transmit on maximum power and hopping on all channels. The span was adjusted to show the individual channels. The display trace was set to Max Hold and the plots recorded.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.4.6 Environmental Conditions

	06 May 2011
Ambient Temperature	24.1°C
Relative Humidity	34.2%



2.4.7 Test Results

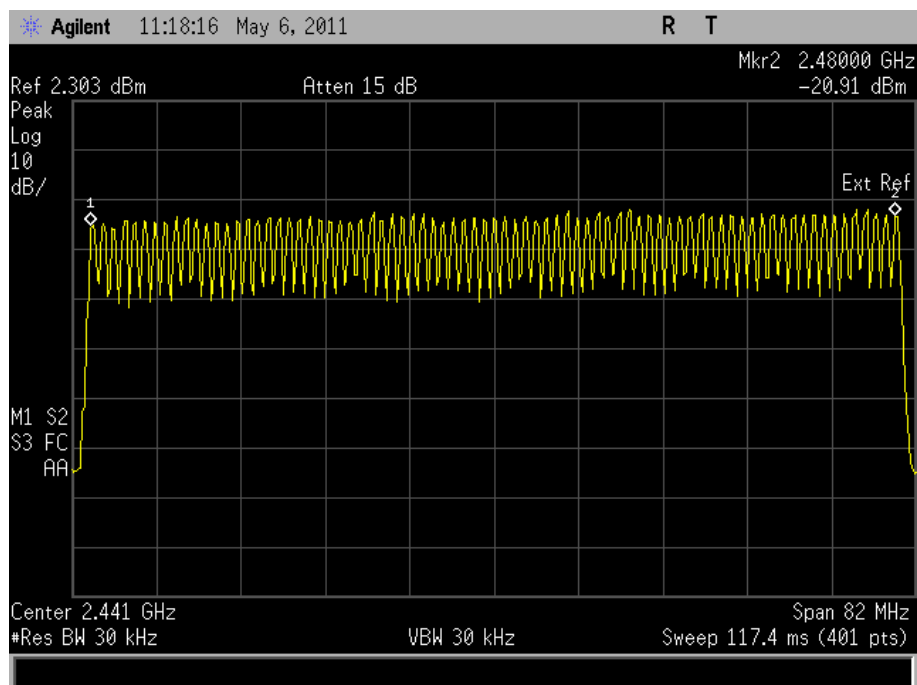
For the period of test the EUT met the requirements of FCC CFR 47 Part 15C for Number of Hopping Channels.

The test results are shown below.

4.0 V DC Supply

Configuration 1 – Modes 1, 2 and 3

0 to 79



Limit

≥ 15 channels



Product Service

2.5 RADIATED EMISSIONS (ENCLOSURE PORT)

2.5.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (a)(2)

2.5.2 Equipment Under Test

CDMA SHI11, S/N: SSHFA001004

2.5.3 Date of Test and Modification State

31 May and 01 June 2011 - Modification State 0

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 Method and Operating Modes

The test was applied in accordance with the test method requirements of ANSI C63.4.

A preliminary profile of the Spurious Radiated Emissions was obtained 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.

Emissions within the restricted bands defined in 15.205 were measured in accordance with 15.209. Emissions measured below 1GHz employed a quasi peak detector, in accordance with 15.35(a). Emissions measured above 1GHz employed an average detector as defined in 15.35(b). The peak level of the emission was also measured to ensure that a difference of 20dB from the average level was not exceeded, as defined in 15.35(b). Emissions identified within the range 30MHz – 1GHz were then formally measured using a CISPR Quasi-Peak detector. Other emissions from 30MHz to 25GHz excluding the restricted bands were measured using a peak detector.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
 - Mode 2
 - Mode 3



Product Service

2.5.6 Environmental Conditions

	31 May 2011	01 June 2011
Ambient Temperature	19.5°C	19.6°C
Relative Humidity	38.0%	43.0%

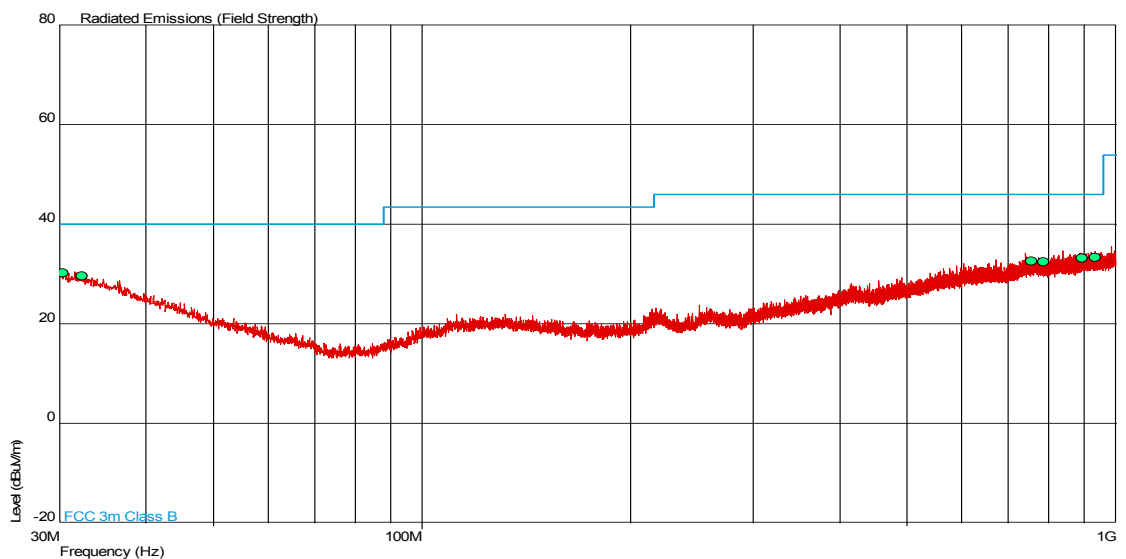
2.5.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 15C for Radiated Emissions (Enclosure Port).

The test results are shown below.

Configuration 1 - Mode 1

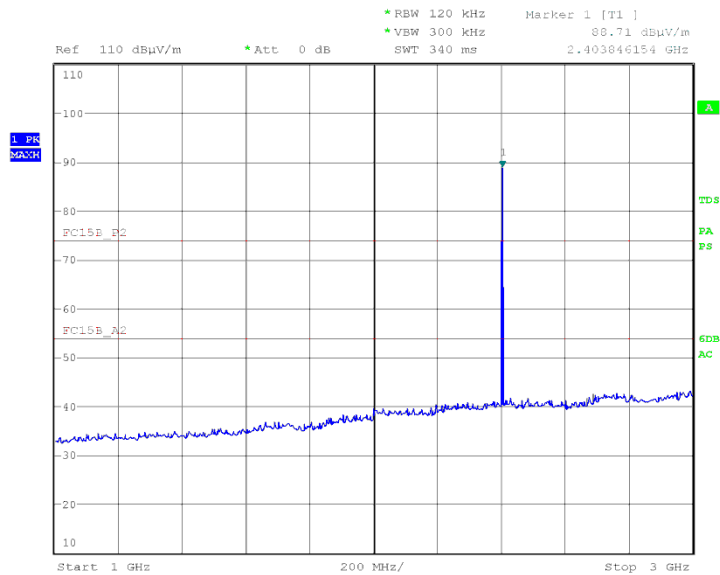
30 MHz to 1 GHz



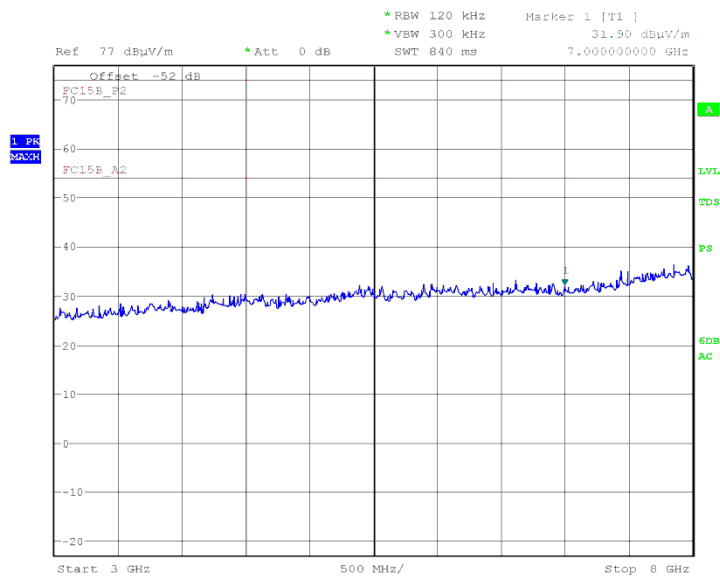
Frequency (MHz)	QP Level (dBμV/m)	QP Level (μV/m)	QP Limit (dBμV/m)	QP Limit (μV/m)	QP Margin (dBμV/m)	QP Margin (μV/m)	Angle (Deg)	Height (m)	Polarity
30.388	30.2	32.4	40.0	100	-9.8	67.6	225	1.00	Vertical
32.328	29.6	30.2	40.0	100	-10.4	69.8	180	1.00	Horizontal
755.027	32.6	42.7	46.0	200	-13.4	157.3	45	1.00	Vertical
786.164	32.4	41.7	46.0	200	-13.6	158.3	180	1.00	Vertical
893.591	33.2	45.7	46.0	200	-12.8	154.3	90	1.00	Vertical
933.458	33.4	46.8	46.0	200	-12.6	153.2	0	1.00	Vertical



Product Service

1GHz to 3GHz

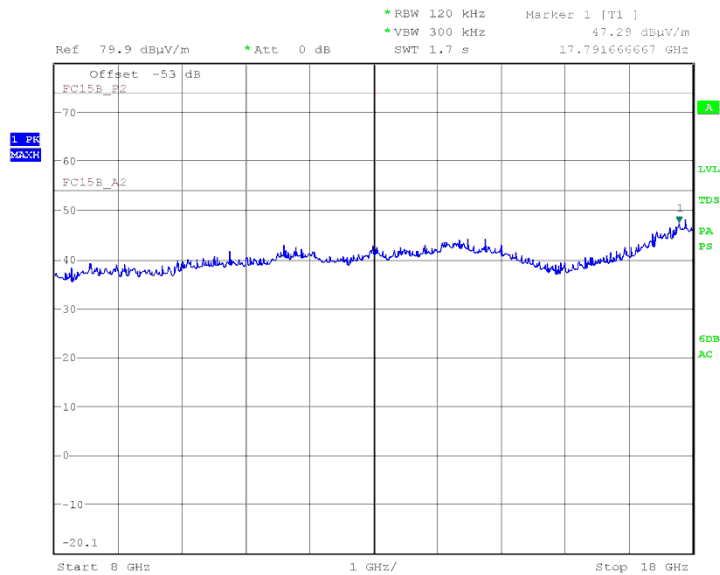
Date: 31.MAY.2011 17:58:53

3GHz to 8GHz

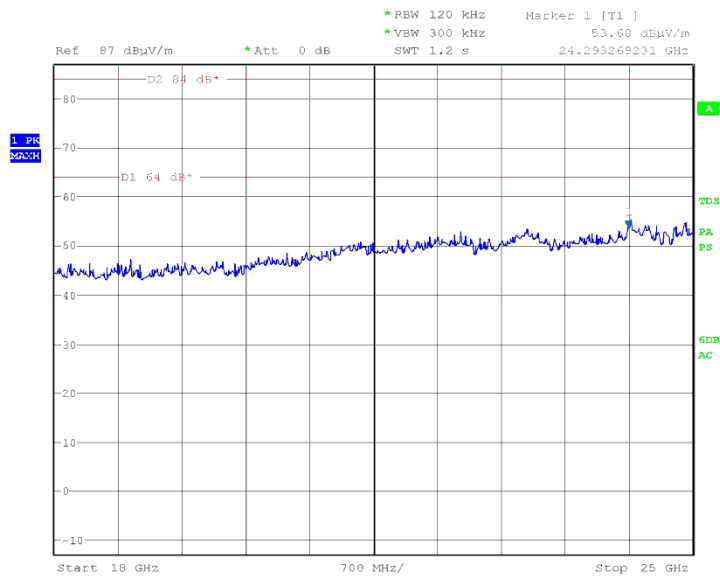
Date: 31.MAY.2011 19:49:31



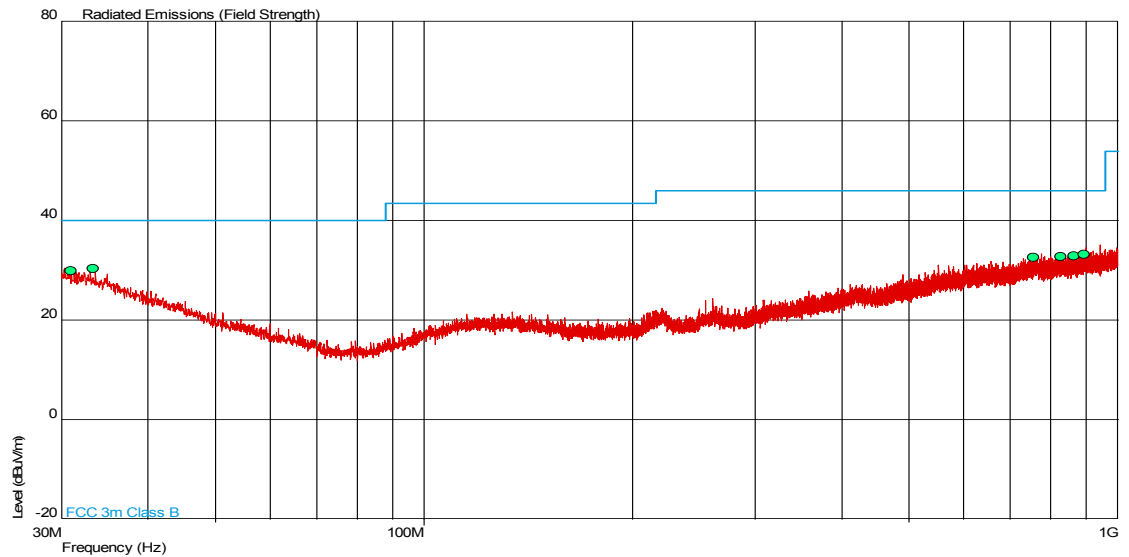
Product Service

8GHz to 18GHz

Date: 31.MAY.2011 20:18:43

18GHz to 25GHz

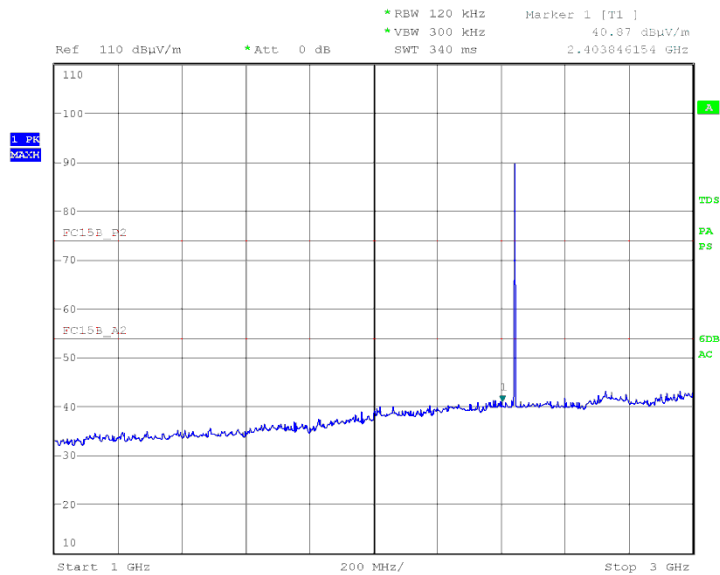
Date: 1.JUN.2011 21:28:37

Configuration 1 - Mode 230 MHz to 1 GHz

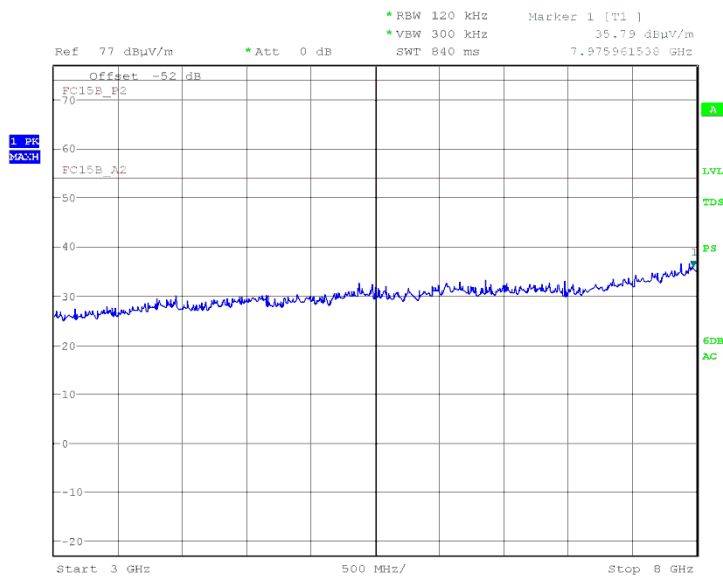
Frequency (MHz)	QP Level (dBμV/m)	QP Level (μV/m)	QP Limit (dBμV/m)	QP Limit (μV/m)	QP Margin (dBμV/m)	QP Margin (μV/m)	Angle (deg)	Height (m)	Polarity
30.922	29.9	31.3	40.0	100	-10.1	68.7	180	1.00	Vertical
33.298	30.4	33.1	40.0	100	-9.6	66.9	180	1.00	Horizontal
754.978	32.6	42.7	46.0	200	-13.4	157.3	180	1.00	Vertical
827.583	32.8	43.7	46.0	200	-13.2	156.3	0	1.00	Vertical
865.025	32.9	44.2	46.0	200	-13.1	155.8	0	1.00	Vertical
892.864	33.1	45.2	46.0	200	-12.9	154.8	180	1.00	Horizontal



Product Service

1GHz to 3GHz

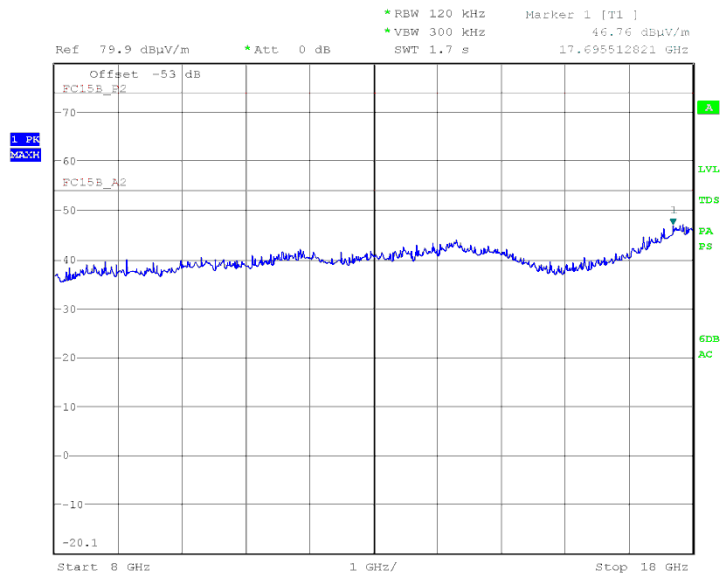
Date: 31.MAY.2011 18:02:26

3GHz to 8GHz

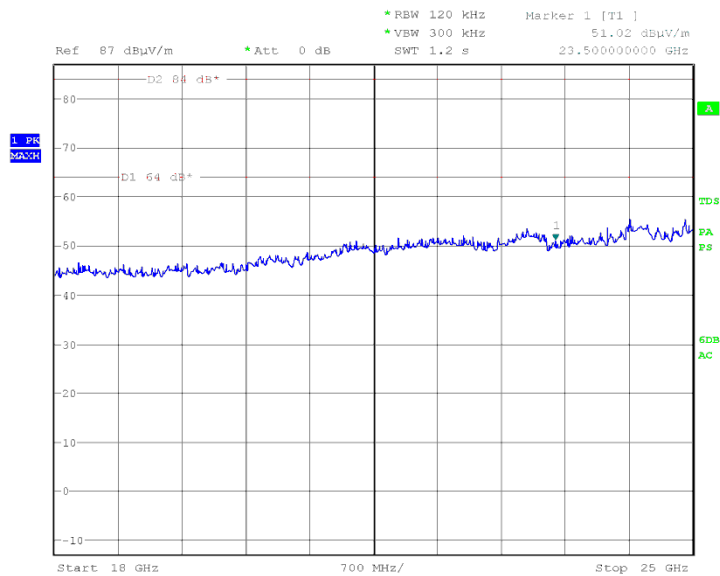
Date: 31.MAY.2011 19:39:09



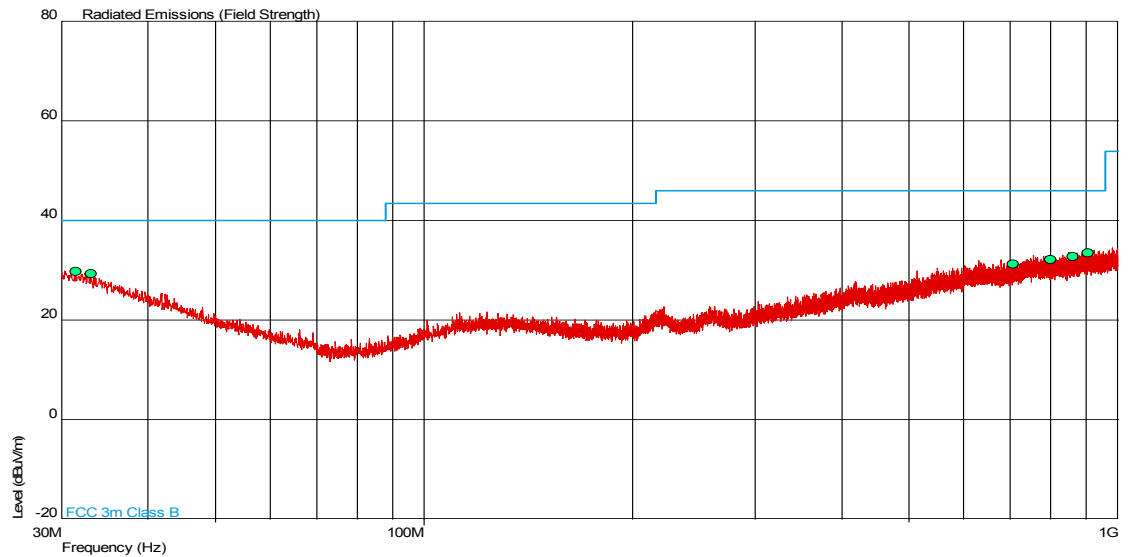
Product Service

8GHz to 18GHz

Date: 31.MAY.2011 20:35:47

18GHz to 25GHz

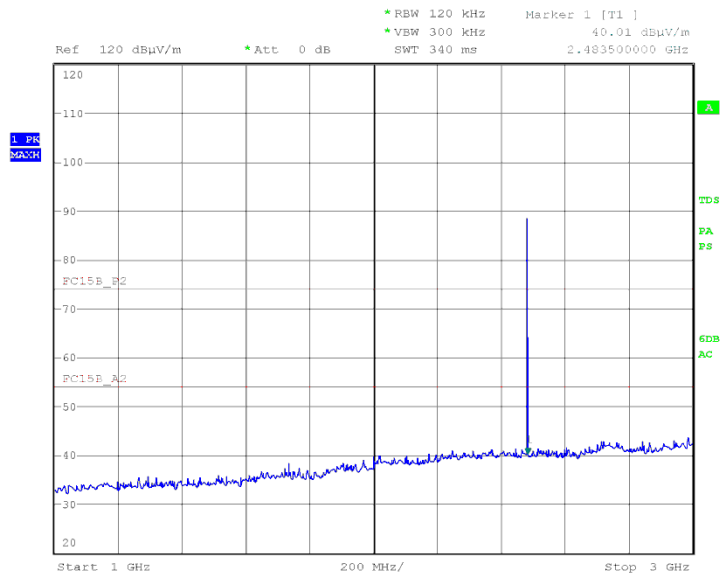
Date: 1.JUN.2011 21:41:48

Configuration 1 - Mode 330 MHz to 1 GHz

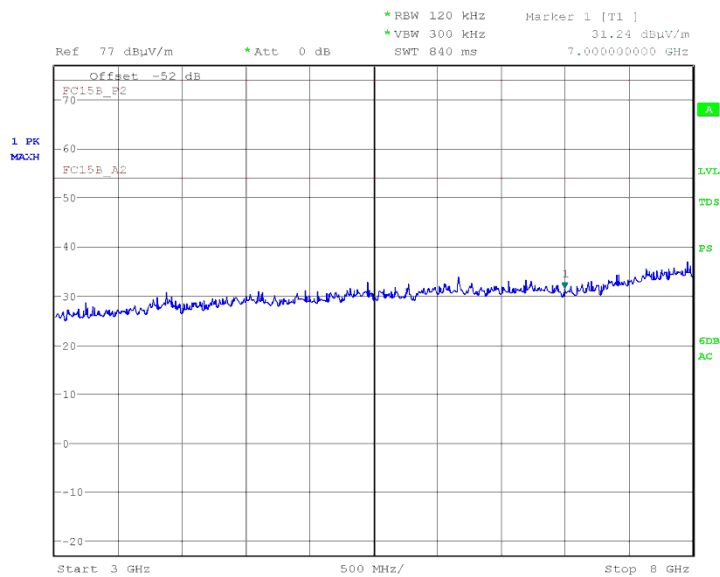
Frequency (MHz)	QP Level (dBμV/m)	QP Level (μV/m)	QP Limit (dBμV/m)	QP Limit (μV/m)	QP Margin (dBμV/m)	QP Margin (μV/m)	Angle (deg)	Height (m)	Polarity
31.504	29.7	30.5	40.0	100	-10.3	69.5	0	1.00	Vertical
33.104	29.3	29.2	40.0	100	-10.7	70.8	180	1.00	Horizontal
706.624	31.3	36.7	46.0	200	-14.7	163.3	0	1.00	Horizontal
799.841	32.2	40.7	46.0	200	-13.8	159.3	180	1.00	Horizontal
862.066	32.7	43.2	46.0	200	-13.3	156.8	180	1.00	Horizontal
907.123	33.5	47.3	46.0	200	-12.5	152.7	0	1.00	Horizontal



Product Service

1GHz to 3GHz

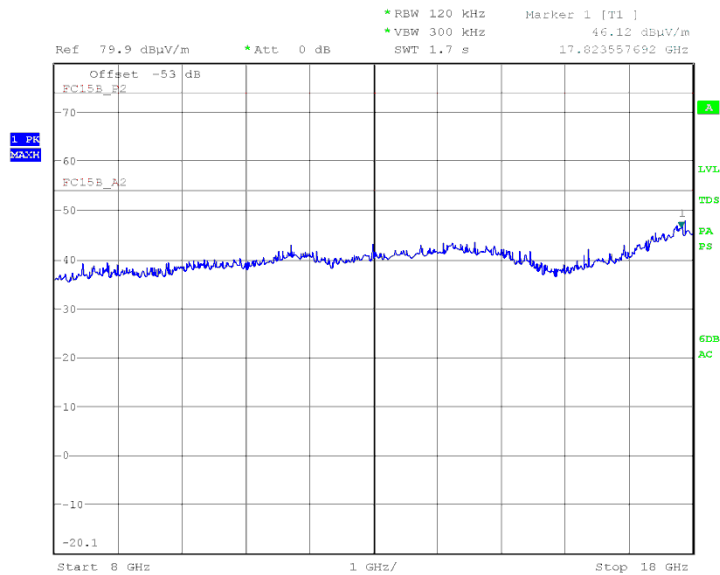
Date: 31.MAY.2011 18:57:15

3GHz to 8GHz

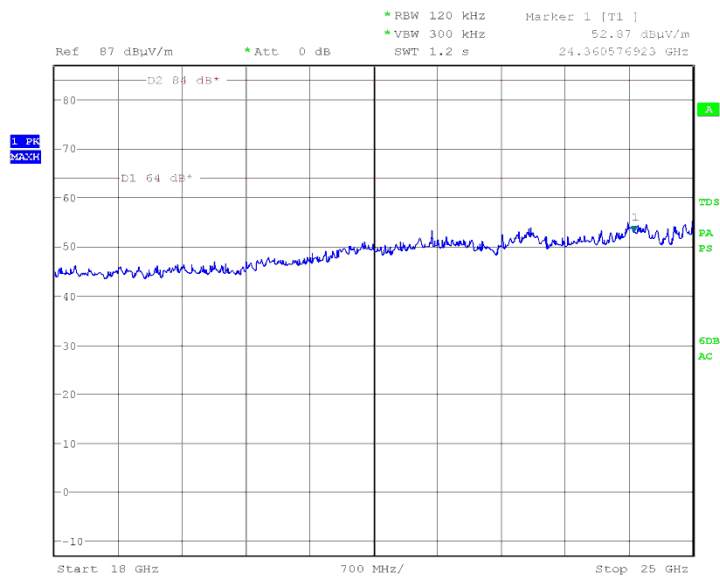
Date: 31.MAY.2011 19:33:35



Product Service

8GHz to 18GHz

Date: 31.MAY.2011 20:57:23

18GHz to 25GHz

Date: 1.JUN.2011 21:56:01



Product Service

2.6 MAXIMUM PEAK CONDUCTED OUTPUT POWER**2.6.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.247 (b)(3)

2.6.2 Equipment Under Test

CDMA SH111, S/N: SSHFA001007

2.6.3 Date of Test and Modification State

12 May 2011 - Modification State 0

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 Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.

The EUT was transmitted at maximum power via a cable to the Peak Power Analyser. The Analyser settings were adjusted to display the resultant trace on screen and a reference level offset was entered to account for the measurement path loss. The measurement bandwidth was set according to the signal being measured and the peak and average levels were recorded.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.6.6 Environmental Conditions

12 May 2011

Ambient Temperature 21.1°C

Relative Humidity 49.8%



2.6.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 15C for Maximum Peak Conducted Output Power.

The test results are shown below.

4.0 V DC Supply

Configuration 1 - Modes 1, 2 & 3

Modulation Data Rate (Mbps)	Maximum Peak Conducted Output Power					
	mW			dBm		
	2402 MHz	2441 MHz	2480 MHz	2402 MHz	2441 MHz	2480 MHz
2DH1	0.91	2.26	2.99	1.23	1.68	1.99
2DH3	0.91	2.39	3.21	1.23	1.73	2.09
2DH5	1.14	2.36	3.08	1.30	1.72	2.03

Limit Clause

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.

For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.



Product Service

2.7 EIRP PEAK POWER**2.7.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.247 (b)(4)

2.7.2 Equipment Under Test

CDMA SH111, S/N: SSHFA001004

2.7.3 Date of Test and Modification State

31 May 2011 - Modification State 0

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 Method and Operating Modes

The test was applied in accordance with the test method requirements of ANSI C63.4.

The EUT was placed on a remotely controlled turntable within a semi-anechoic chamber. Measurements of the carrier frequency from the EUT were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

The measurement was performed with a peak detector and the trace set to max hold using a Resolution and Video bandwidth of 1 MHz.

A substitution was then performed by replacing the EUT with a substitution antenna and signal generator. The signal generator level was increased to achieve the same raw result as the EUT. Cable loss and antenna gain was included to obtain the result.

A wideband power metre was then used to apply a correction factor to achieve the final result.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
 - Mode 2
 - Mode 3

2.7.6 Environmental Conditions

31 May 2011

Ambient Temperature 19.5°C

Relative Humidity 38.0%



Product Service

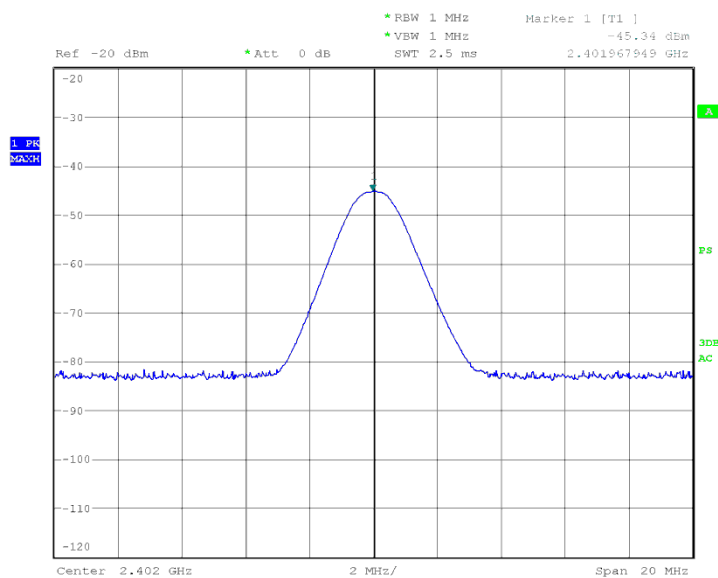
2.7.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 15C for EIRP Peak Power.

The test results are shown below.

Configuration 1 - Mode 1

Freq GHz	Result EIRP dBm	Limit EIRP dBm	Result EIRP mW	Limit EIRP mW
2.402	-3.1	36.0	0.490	4000



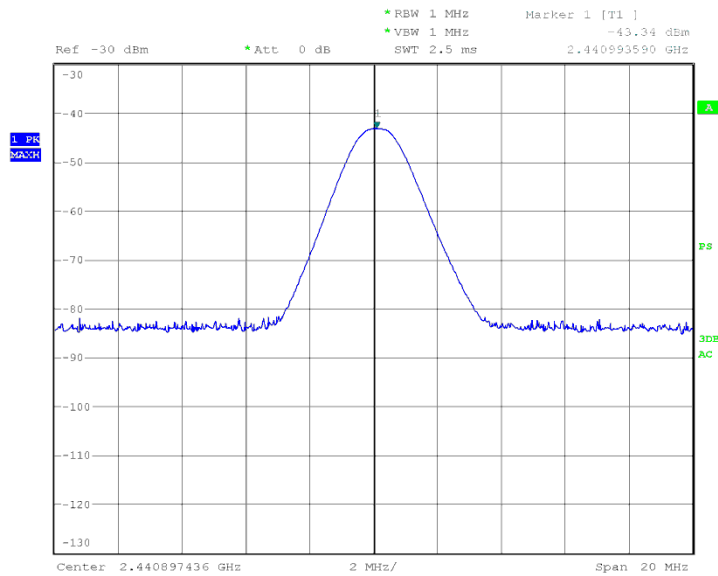
Date: 31.MAY.2011 17:41:52



Product Service

Configuration 1 - Mode 2

Freq GHz	Result EIRP dBm	Limit EIRP dBm	Result EIRP mW	Limit EIRP mW
2.441	-1.4	36.0	0.724	4000



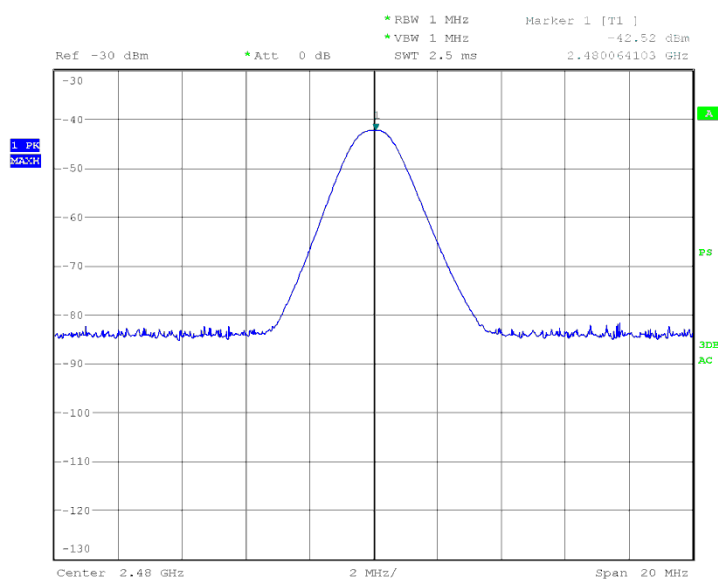
Date: 31.MAY.2011 18:13:59



Product Service

Configuration 1 - Mode 3

Freq GHz	Result EIRP dBm	Limit EIRP dBm	Result EIRP mW	Limit EIRP mW
2.480	-0.9	36.0	0.813	4000



Date: 31.MAY.2011 18:41:46



Product Service

2.8 SPURIOUS EMISSIONS**2.8.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.247 (d)

2.8.2 Equipment Under Test

CDMA SHI11, S/N: SSHFA001007

2.8.3 Date of Test and Modification State

10 June 2011 - Modification State 0

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 Method and Operating Modes

The test was applied in accordance with FCC CFR 47 Part 15.

In accordance with Part 15.247(d), the Spurious Conducted 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 25 GHz. The EUT was set to transmit on full power. The resolution and video bandwidths were set to 100 kHz in accordance with Part 15.247. The spectrum analyser detector was set to Max Hold.

With the EUT transmitting at maximum power, the Spectrum Analyser was set to Max Hold and the fundamental peak measured in a RBW and VBW of 100 kHz. This level was used to determine the limit line as displayed on the plots of -20dBc.

The maximum path loss across each measurement band was used as the reference level offset to ensure worst case results.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 4

2.8.6 Environmental Conditions

10 June 2011

Ambient Temperature 20.9°C

Relative Humidity 40.1%



2.8.7 Test Results

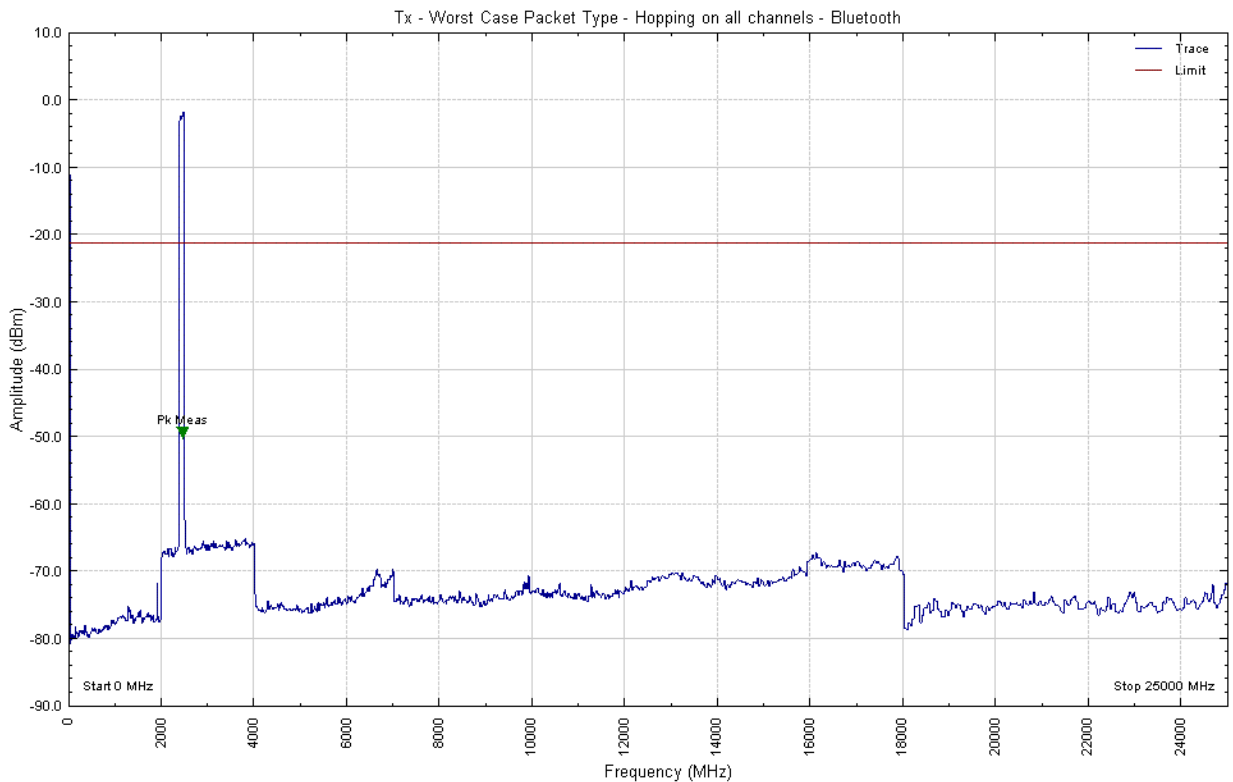
For the period of test the EUT met the requirements of FCC CFR 47 Part 15C for Spurious Emissions.

The test results are shown below.

4.0 V DC Supply

Configuration 1 – Modes 1, 2 and 3

9 kHz to 25 GHz



Limit Clause

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval the attenuation required shall be 30 dB instead of 20 dB.



Product Service

2.9 BAND EDGE EMISSIONS**2.9.1 Specification Reference**

FCC CFR 47 Part 15C, Clause 15.247 (d)

2.9.2 Equipment Under Test

CDMA SH111, S/N: SSHFA001004

2.9.3 Date of Test and Modification State

31 May 2011 - Modification State 0

2.9.4 Test Equipment Used

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

2.9.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of ANSI C63.4.

The band edge measurements were performed in accordance with ANSI C63.10, Clause 6.9.3. The results were analysed to ensure compliance with restricted bands. The EUT was set to the lowest and highest operating frequencies.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
 - Mode 3

2.9.6 Environmental Conditions

31 May 2011

Ambient Temperature 19.5°C

Relative Humidity 38.0%



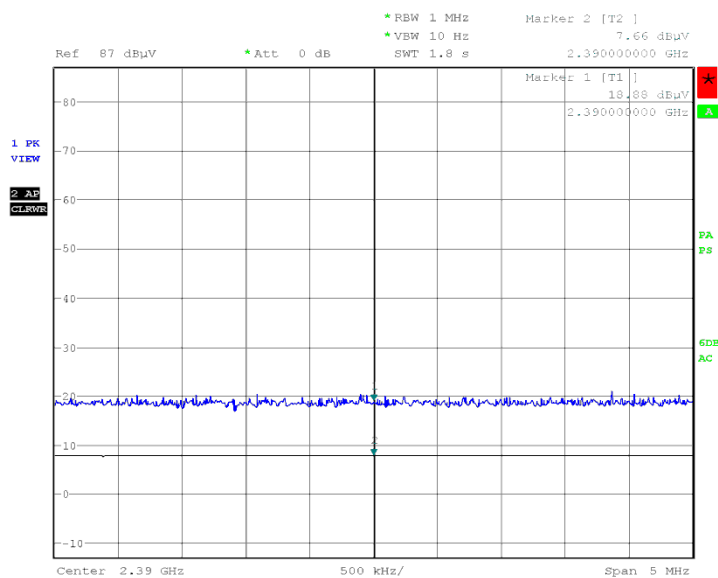
2.9.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 15C for Band Edge Emissions.

The test results are shown below.

Configuration 1 - Mode 1

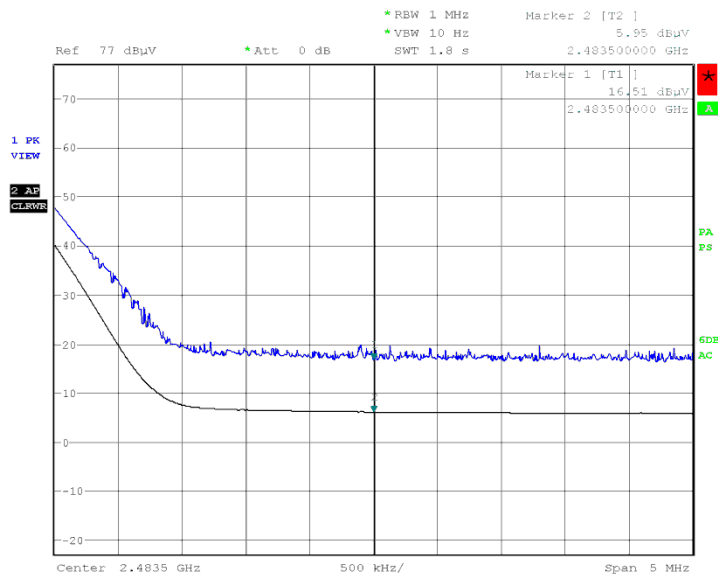
Freq in GHz	Polarisation	Final Peak dB μ V/m	Peak Limit dB μ V/m	Final Average dB μ V/m	Average Limit dB μ V/m
2.402	Horizontal	45.6	74.0	33.3	54.0



Date: 31.MAY.2011 17:48:16

Configuration 1 - Mode 3

Freq in GHz	Polarisation	Final Peak dBμV/m	Peak Limit dBμV/m	Final Average dBμV/m	Average Limit dBμV/m
2.480	Horizontal	45.8	74.0	33.5	54.0



Date: 31.MAY.2011 18:54:01



Product Service

SECTION 3

TEST EQUIPMENT USED



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 - 20 dB Bandwidth					
Multimeter	Iso-tech	IDM-101	466	12	2-Mar-2012
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jun-2011
Hygrometer	Rotronic	A1	1388	12	10-Jul-2011
Power Supply	Iso-tech	IPS 2010	2439	-	O/P Mon
Power Meter	Rohde & Schwarz	NRP	3491	12	19-Apr-2012
Wideband Power Sensor, 50MHz - 18GHz	Rohde & Schwarz	NRP-Z81	3492	12	19-Apr-2012
Vector Signal Generator	Rohde & Schwarz	SMU 200A	3493	12	10-Aug-2011
Combiner/Splitter	Weinschel	1506A	3877	12	22-Feb-2012
Section 2.2 - Channel Separation					
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Multimeter	Iso-tech	IDM-101	466	12	2-Mar-2012
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jun-2011
Power Supply	Iso-tech	IPS 2010	2439	-	O/P Mon
Hygrometer	Rotronic	A1	2677	12	20-Jan-2012
Thermocouple Thermometer	Fluke	51	3173	12	12-Jul-2011
Vector Signal Generator	Rohde & Schwarz	SMU 200A	3493	12	10-Aug-2011
Section 2.3 - Channel Dwell Time					
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Multimeter	Iso-tech	IDM-101	466	12	2-Mar-2012
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jun-2011
Power Supply	Iso-tech	IPS 2010	2439	-	O/P Mon
Hygrometer	Rotronic	A1	2677	12	20-Jan-2012
Thermocouple Thermometer	Fluke	51	3173	12	12-Jul-2011
Vector Signal Generator	Rohde & Schwarz	SMU 200A	3493	12	10-Aug-2011
Section 2.4 - Number of Hopping Channels					
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Multimeter	Iso-tech	IDM-101	466	12	2-Mar-2012
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jun-2011
Power Supply	Iso-tech	IPS 2010	2439	-	O/P Mon
Hygrometer	Rotronic	A1	2677	12	20-Jan-2012
Thermocouple Thermometer	Fluke	51	3173	12	12-Jul-2011
Vector Signal Generator	Rohde & Schwarz	SMU 200A	3493	12	10-Aug-2011
Section 2.5, 2.7 and 2.9 - Radiated Emissions (Enclosure Port) and EIRP Peak Power, Band Edge Emissions					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	12-Nov-2011
Antenna (Bilog)	Schaffner	CBL6143	287	24	19-Jan-2012
Antenna (Double Ridge Guide)	Q-Par Angus Ltd	QSH 180K	1511	24	2-Aug-2012
Pre-Amplifier	Phase One	PS04-0086	1533	12	15-Sep-2011
Pre-Amplifier	Phase One	PS04-0087	1534	12	22-Sep-2011
Screened Room (5)	Rainford	Rainford	1545	24	3-Feb-2014
Mast Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	12-Aug-2011
Amplifier (1 - 8GHz)	Phase One	PS06-0060	3175	12	2-Jul-2011
Amplifier (8 - 18GHz)	Phase One	PS06-0061	3176	12	2-Jul-2011
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	9-Sep-2011
3 GHz High Pass Filter	K&L Microwave	11SH10-3000/X18000-O/O	3552	12	14-Apr-2012
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	12	10-Aug-2011
Tilt Antenna Mast	mature GmbH	TAM 4.0-P	3916	-	TU



Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Section 2.6 – Maximum Peak Conducted Output Power					
Peak Power Analyser	Hewlett Packard	8990A	107	12	11-Feb-2012
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Multimeter	Iso-tech	IDM-101	466	12	2-Mar-2012
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	23-Jun-2011
Signal Generator	Marconi	2031	762	12	28-Oct-2011
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jun-2011
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	11-Sep-2011
Hygrometer	Rotronic	A1	1388	12	10-Jul-2011
Hygrometer	Rotronic	A1	2138	12	14-Jun-2011
Power Supply	Iso-tech	IPS 2010	2439	-	O/P Mon
Hygrometer	Rotronic	A1	2677	12	20-Jan-2012
Power Sensor	Hewlett Packard	84812A	2743	-	TU
Attenuator (20dB, 20W)	Weinschel	1	3032	12	9-Jul-2011
Thermocouple Thermometer	Fluke	51	3173	12	12-Jul-2011
Power Meter	Rohde & Schwarz	NRP	3491	12	19-Apr-2012
Wideband Power Sensor, 50MHz - 18GHz	Rohde & Schwarz	NRP-Z81	3492	12	19-Apr-2012
Vector Signal Generator	Rohde & Schwarz	SMU 200A	3493	12	10-Aug-2011
Signal Generator, 9kHz to 3GHz	Rohde & Schwarz	SMA 100A	3494	12	25-Jan-2012
Combiner/Splitter	Weinschel	1506A	3877	12	22-Feb-2012
Combiner/Splitter	Weinschel	1506A	3880	12	22-Feb-2012
Section 2.8 - Radiated Spurious Emissions					
Standard Gain Horn Antenna (20dB)	Flann	1624-20	28	12	27-Apr-2012
Antenna (Double Ridge Guide)	EMCO	3115	34	12	17-Jul-2011
Spectrum Analyser	Rohde & Schwarz	FSEM	37	12	18-Apr-2012
Screened Room (8)	Rainford	Rainford	1548	-	TU
Programmable Power Supply	Iso-tech	IPS 2010	2435	-	O/P Mon
Hygrometer	Rotronic	I-1000	2882	12	10-Jul-2011
Antenna (Biconnical)	Schaffner	VBA6106A	3107	12	23-Aug-2011
Antenna (Log Periodic)	Schaffner	UPA6108	3109	12	30-Mar-2012
Amplifier (1 - 8GHz)	Phase One	PS06-0060	3175	12	2-Jul-2011
Amplifier (8 - 18GHz)	Phase One	PS06-0061	3176	12	2-Jul-2011
3 GHz High Pass Filter	K&L Microwave	11SH10-3000/X18000-O/O	3552	12	14-Apr-2012
Low Noise Pre Amplifier	Mini-Circuits	ZHL-1042J	3602	12	6-Dec-2011

TU – Traceability Unscheduled

O/P Mon – Output monitored using calibrated equipment.



3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	Frequency / Parameter	MU
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*
Conducted Emissions, LISN	150kHz to 30MHz Amplitude	3.2dB*
Conducted Emissions, ISN	150kHz to 30MHz Amplitude	2.1dB
Substitution Antenna, Radiated Field	30MHz to 18GHz Amplitude	2.6dB
Discontinuous Interference	150kHz to 30MHz Amplitude	3.0dB*
Interference Power	30MHz to 300MHz Amplitude	3.0dB*
Radiated E-Field Susceptibility	10MHz to 6GHz Test Amplitude	2.0dB†
Conducted Susceptibility RF	50kHz to 1000MHz Amplitude	3.1dB•
	EM Clamp Method of Test	1.2dB•
	CDN Method of Test	1.1dB•
	BCI Clamp Method of Test	1.2dB•
Conducted Susceptibility LF	DC to 150kHz	1.0%†
Power Frequency Magnetic Field	50Hz/60Hz Amplitude	0.45%
Magnetic Emissions	9kHz to 30MHz Amplitude	3.4dB*
Magnetic Field/Flux iaw EN 50366	10Hz to 400kHz	2.64%
Harmonics and Flicker	The test was applied using proprietary equipment that meets the requirements of EN 61000-3-2 and EN 61000-3-3	—
Mains Voltage Variations and Interrupts	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-11	—
Fast Transient Burst	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-4	—
Electrostatic Discharge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2	—
Surge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-5	—
Vehicle Transients	The test was applied using proprietary equipment that meets the requirements of ISO 7637-1 and 2	—
Compass Safe Distance	Azimuth Accuracy	0.10°
Channel Occupancy/Separation	19.1kHz	N/A
Maximum Output Power	Not Applicable	±0.5dB
Number of Channels	Not Applicable	N/A
20dB Bandwidth	19.1kHz	±0.5dB

Worst case error for both Time and Frequency measurement 12 parts in 10^6 .

- * In accordance with CISPR 16-4-2
- † In accordance with UKAS Lab 34
- In accordance with EN61000-4-6



Product Service

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



Product Service

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
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