



Product Service

**Choose certainty.
Add value.**

Report On

FCC Testing of the Sharp CDMA SHL21 Dual Band CDMA (BC0 and BC6) and Tri Band GSM (900, 1800 and 1900 MHz) and Dual Band UMTS (FDD I and V) and Dual Band LTE (B11 and B18) Multi Mode Cellular Phone with Bluetooth, WLAN, NFC (FeliCa) and GPS
In accordance with FCC CFR 47 Part 15C (Bluetooth)

COMMERCIAL-IN-CONFIDENCE

FCC ID: APYHRO00178

Document 75918726 Report 13 Issue 1

October 2012



Product Service

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

COMMERCIAL-IN-CONFIDENCE

REPORT ON

FCC Testing of the Sharp CDMA SHL21 Dual Band CDMA (BC0 and BC6) and Tri Band GSM (900, 1800 and 1900 MHz) and Dual Band UMTS (FDD I and V) and Dual Band LTE (B11 and B18) Multi Mode Cellular Phone with Bluetooth, WLAN, NFC (FeliCa) and GPS
In accordance with FCC CFR 47 Part 15C (Bluetooth)

Document 75918726 Report 13 Issue 1

October 2012

PREPARED FOR

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

PREPARED BY


Maggie Whiting
Senior Engineer

APPROVED BY


Mark Jenkins
Authorised Signatory

DATED

02 October 2012

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);


G Lawler


M Russell





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 7
1.6	Deviations from the Standard 7
1.7	Modification Record 7
2	TEST DETAILS 8
2.1	AC Line Conducted Emissions 9
2.2	Frequency Hopping Systems - 20dB Bandwidth and Channel Separation 12
2.3	Frequency Hopping Systems - Channel Dwell Time and Number of Hopping Channels 20
2.4	Maximum Peak Conducted Output Power 27
2.5	EIRP Peak Power 29
2.6	Spurious and Band Edge Emissions 33
3	TEST EQUIPMENT USED 46
3.1	Test Equipment Used 47
3.2	Measurement Uncertainty 52
4	ACCREDITATION, DISCLAIMERS AND COPYRIGHT 53
4.1	Accreditation, Disclaimers and Copyright 54



Product Service

SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp CDMA SHL21 Dual Band CDMA (BC0 and BC6) and Tri Band GSM (900, 1800 and 1900
MHz) and Dual Band UMTS (FDD I and V) and Dual Band LTE (B11 and B18) Multi Mode
Cellular Phone with Bluetooth, WLAN, NFC (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 the FCC Testing of the Sharp CDMA SHL21 Dual Band CDMA (BC0 and BC6) and Tri Band GSM (900, 1800 and 1900 MHz) and Dual Band UMTS (FDD I and V) and Dual Band LTE (B11 and B18) Multi Mode Cellular Phone with Bluetooth, WLAN, NFC (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
Model Number(s)	CDMA SHL21
Serial Number(s)	IMEI 004401114094630 IMEI 004401114094432
Number of Samples Tested	2
Test Specification/Issue/Date	FCC CFR 47 Part 15C (2011)
Incoming Release Date	Application Form 30 July 2012
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	9290 03 August 2012
Start of Test	14 August 2012
Finish of Test	18 September 2012
Name of Engineer(s)	G Lawler M Russell
Related Document(s)	ANSI C63.10: 2009



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 15C is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
Bluetooth				
2.1	15.207	AC Line Conducted Emissions	Pass	
2.2	15.247 (a)(1)	Frequency Hopping Systems - 20dB Bandwidth and Channel Separation	Pass	
2.3	15.247 (a)(1)(iii)	Frequency Hopping Systems - Channel Dwell Time and Number of Hopping Channels	Pass	
2.4	15.247 (b)(3)	Maximum Peak Conducted Output Power	Pass	
2.5	15.247 (b)(4)	EIRP Peak Power	Pass	
2.6	15.247 (d)	Spurious and Band Edge Emissions	Pass	



Product Service

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 SHL21	Identification number	APYHRO00178
<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	2402MHz to 2480MHz	Channel spacing	(if channelized)
Designated test frequencies:			
Bottom: 2402 MHz	Middle: 2441 MHz	Top: 2480MHz	
<u>Power characteristics:</u>			
Maximum transmitter power	0.004W(6dBm)	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 impedanceohm	
☒	Temporary antenna connector	State impedance 50 ohm	
☐	Integral antenna	State gain	
<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	55 °C	Minimum temperature	-10 °C
Maximum supply voltage	4.0 V	Minimum supply voltage	3.7 V

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

Signature :

Name : Masahiko Kishino

Position held : Manager

Date : 30 July 2012



Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp CDMA SHL21 Dual Band CDMA (BC0 and BC6) and Tri Band GSM (900, 1800 and 1900 MHz) and Dual Band UMTS (FDD I and V) and Dual Band LTE (B11 and B18) Multi Mode Cellular Phone with Bluetooth, WLAN, NFC (FeliCa) and GPS. A full technical description can be found in the manufacturer's documentation.

1.5 TEST CONDITIONS

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

The EUT was powered from a 4.0 V DC supply.

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard or test plan 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 CDMA SHL21 Dual Band CDMA (BC0 and BC6) and Tri Band GSM (900, 1800 and 1900
MHz) and Dual Band UMTS (FDD I and V) and Dual Band LTE (B11 and B18) Multi Mode
Cellular Phone with Bluetooth, WLAN, NFC (FeliCa) and GPS
In accordance with FCC CFR 47 Part 15C (Bluetooth)



Product Service

2.1 AC LINE CONDUCTED EMISSIONS

2.1.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.207

2.1.2 Equipment Under Test and Modification State

CDMA SHL21 S/N: IMEI 004401114094630 - Modification State 0

2.1.3 Date of Test

18 September 2012

2.1.4 Test Equipment Used

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

2.1.5 Test Procedure

The EUT is set up on a test table 800mm above a horizontal ground plane. A vertical ground plane is also required and is placed 400mm from the EUT. Where a EUT is floor standing it will be stood on but insulated from the ground plane by up to 12mm.

The EUT is powered through a Line Impedance Stabilisation Network (LISN) which is bonded to the ground plane. The EUT is located so that the distance between the EUT and the LISN is no less than 800mm. Where possible the cable between the mains input of the EUT and the LISN is 1m. Where this is not possible the cable is non inductively bundled with the bundle not exceeding 400mm in length.

A preliminary profile of the Conducted Emissions is obtained over the frequency range 150kHz to 30MHz. Any points of interest are noted for formal measurements.

During formal measurements, the measuring receiver is tuned to the emission of interest where Quasi – Peak and Average measurements are performed in a 9kHz Video and Resolution Bandwidth.

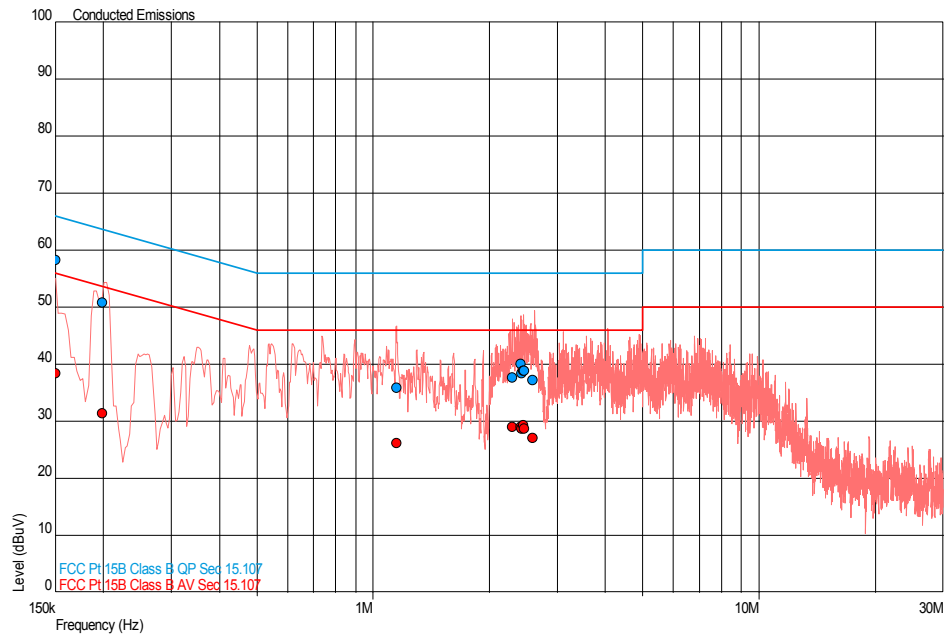
2.1.6 Environmental Conditions

Ambient Temperature	19.3°C
Relative Humidity	40.0%



2.1.7 Test Results

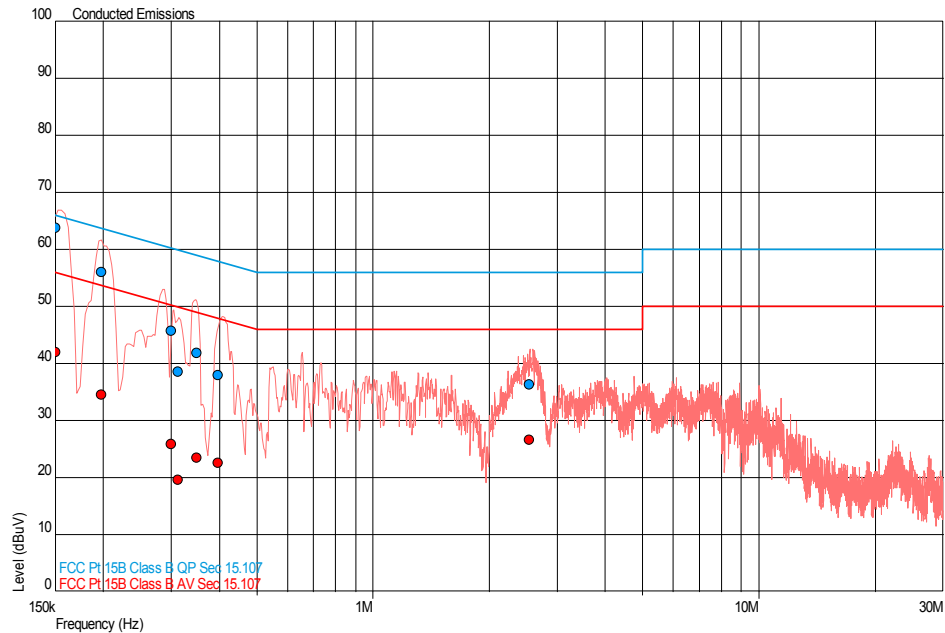
Live Line



Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dBμV)	AV Level (dBμV)	AV Limit (dBμV)	AV Margin (dBμV)	
0.150	58.3	66.0	-7.7	38.4	56.0	-17.6	
0.199	50.9	63.7	-12.8	31.4	53.7	-22.2	
1.149	36.0	56.0	-20.0	26.3	46.0	-19.7	
2.297	37.6	56.0	-18.4	29.0	46.0	-17.0	
2.411	40.1	56.0	-15.9	29.0	46.0	-17.0	
2.422	38.4	56.0	-17.6	28.7	46.0	-17.3	
2.450	38.9	56.0	-17.1	29.3	46.0	-16.7	
2.461	38.8	56.0	-17.2	28.7	46.0	-17.3	
2.598	37.3	56.0	-18.7	27.1	46.0	-18.9	



Neutral Line



Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dBμV)	AV Level (dBμV)	AV Limit (dBμV)	AV Margin (dBμV)
0.150	63.8	66.0	-2.2	42.1	56.0	-13.9
0.198	56.1	63.7	-7.6	34.5	53.7	-19.2
0.301	45.8	60.2	-14.5	25.8	50.2	-24.4
0.312	38.6	59.9	-21.4	19.6	49.9	-30.3
0.350	41.8	59.0	-17.2	23.5	49.0	-25.5
0.395	37.9	57.9	-20.0	22.6	47.9	-25.3
2.538	36.3	56.0	-19.7	26.6	46.0	-19.4



Product Service

2.2 FREQUENCY HOPPING SYSTEMS - 20DB BANDWIDTH AND CHANNEL SEPARATION

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

CDMA SHL21 S/N: IMEI 004401114094432 - Modification State 0

2.2.3 Date of Test

14 August 2012

2.2.4 Test Equipment Used

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

2.2.5 Test Procedure

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 -20dBc points of the displayed spectrum.

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.

2.2.6 Environmental Conditions

Ambient Temperature	24.6°C
Relative Humidity	45.8%



Product Service

2.2.7 Test Results

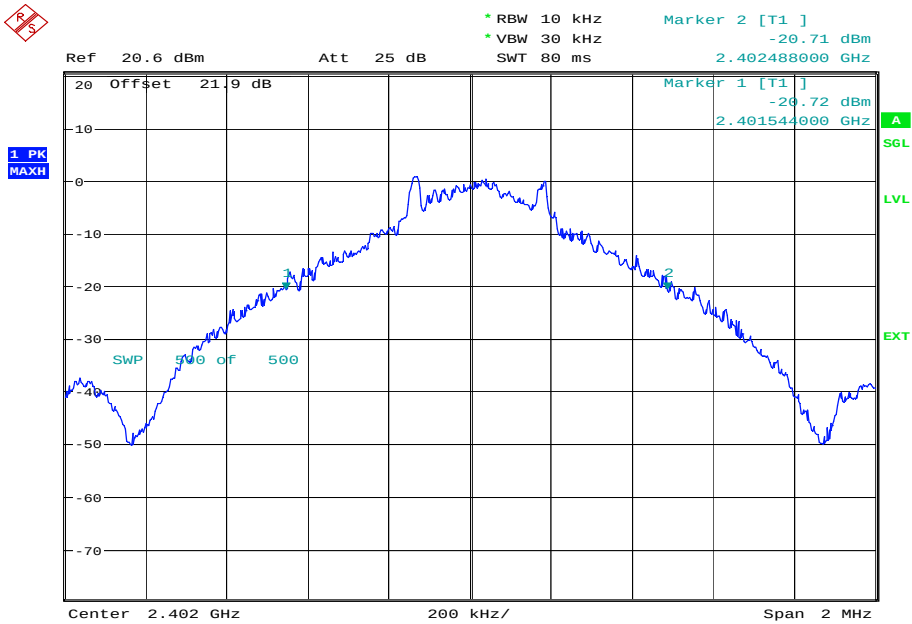
4.0 V DC Supply

20dB Bandwidth

2402 MHz

Data Rate (Mbps)	20dB Bandwidth (kHz)
DH1	944.0
DH3	966.4
DH5	969.6

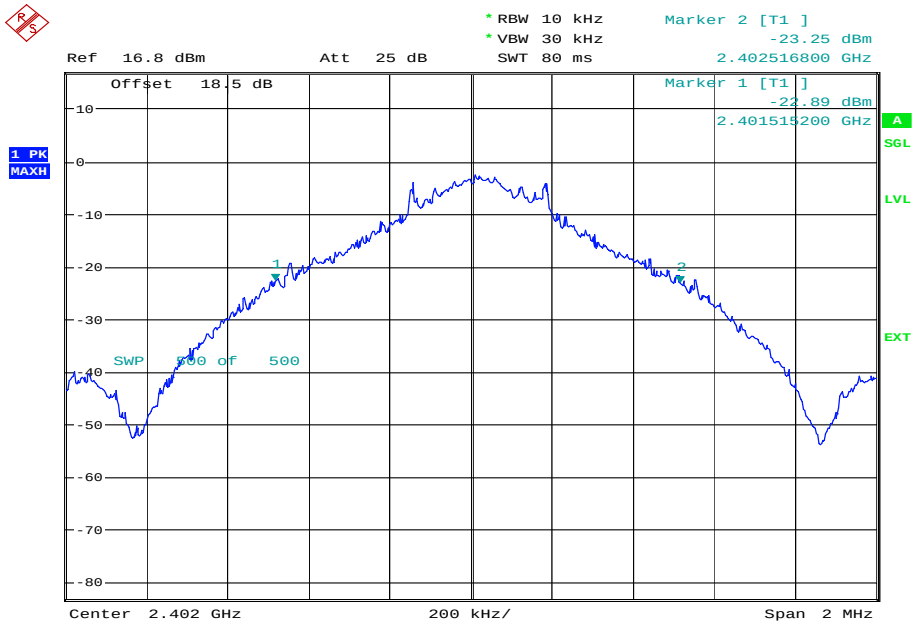
DH1





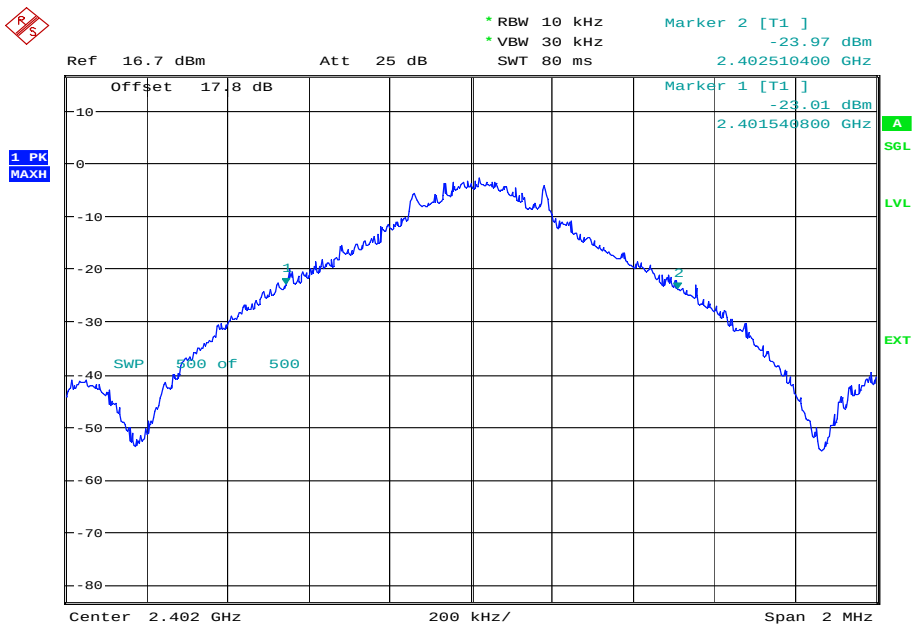
Product Service

DH3



Date: 14.AUG.2012 11:59:01

DH5



Date: 14.AUG.2012 11:17:27

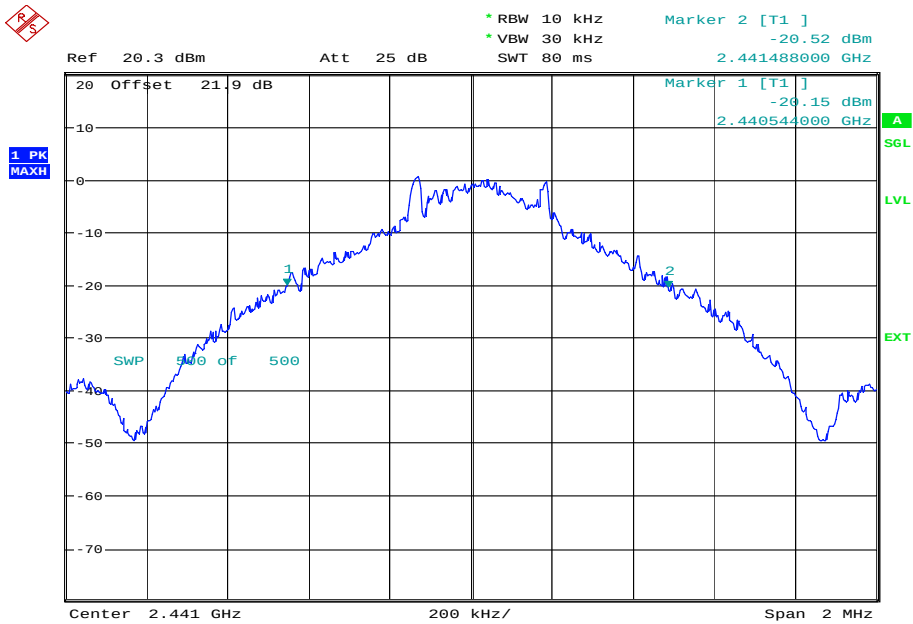


Product Service

2441 MHz

Data Rate (Mbps)	20dB Bandwidth (kHz)
DH1	944.0
DH3	985.6
DH5	966.4

DH1

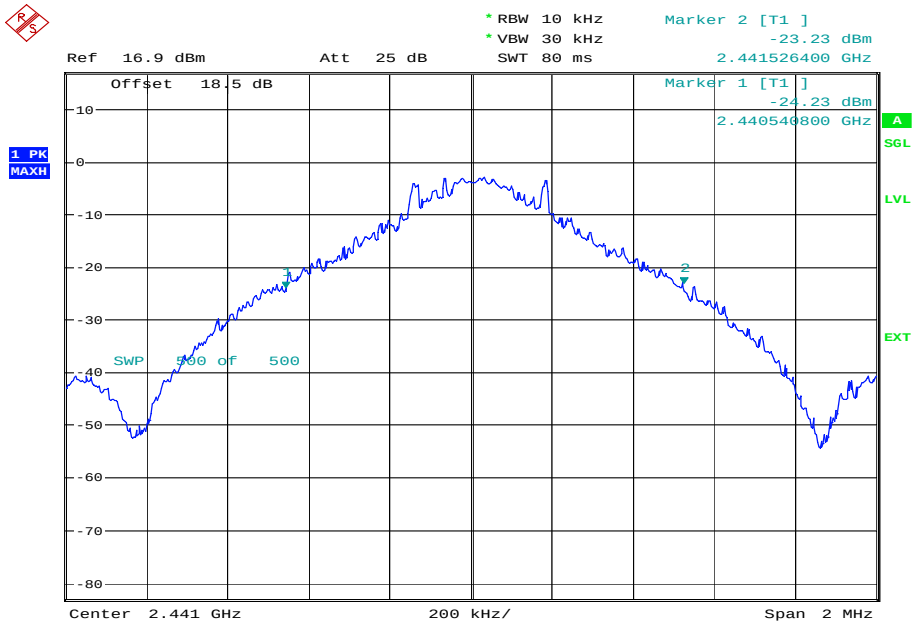


Date: 14.AUG.2012 13:28:01



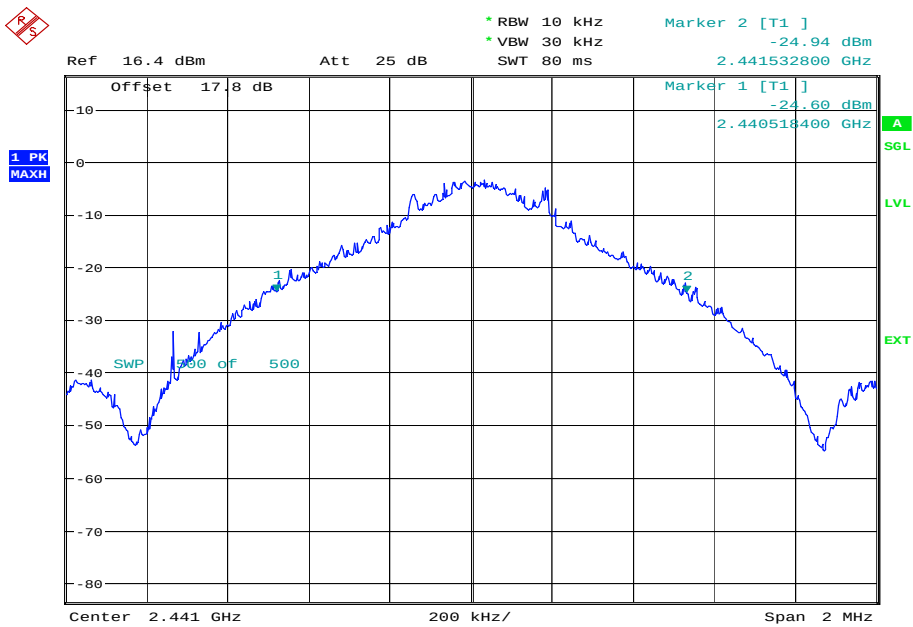
Product Service

DH3



Date: 14.AUG.2012 13:34:50

DH5



Date: 14.AUG.2012 12:44:45

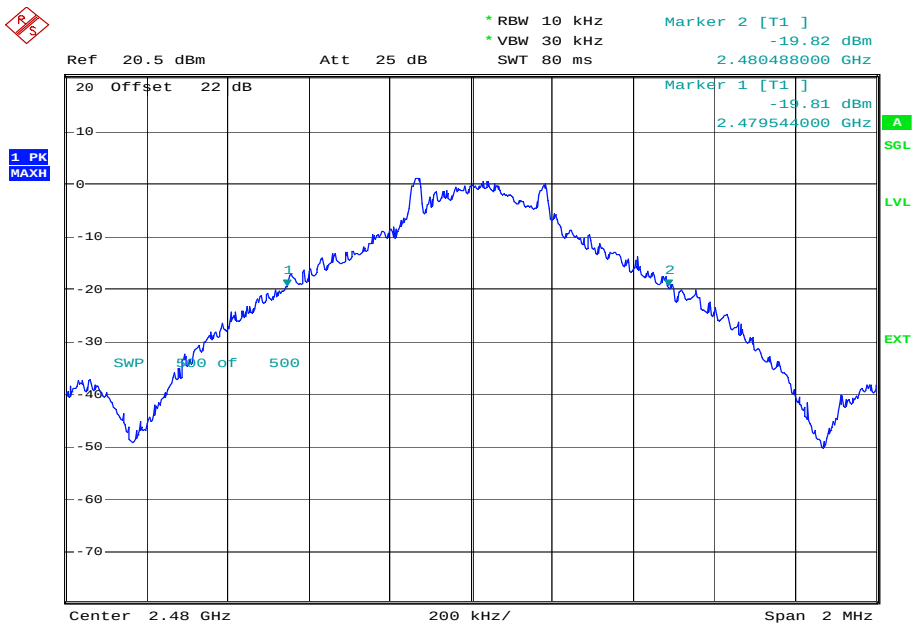


Product Service

2480 MHz

Data Rate (Mbps)	20dB Bandwidth (kHz)
DH1	944.0
DH3	985.6
DH5	955.2

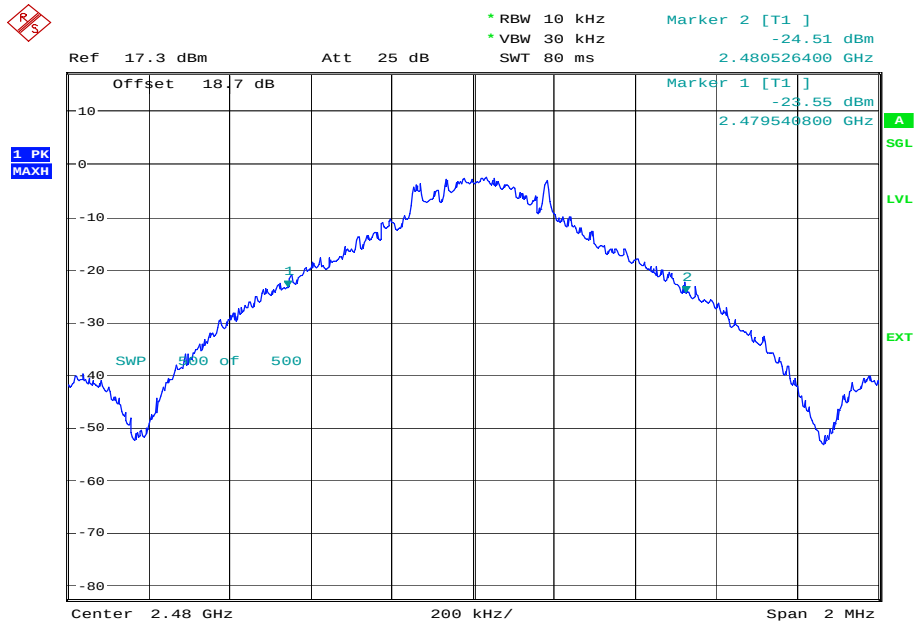
DH1



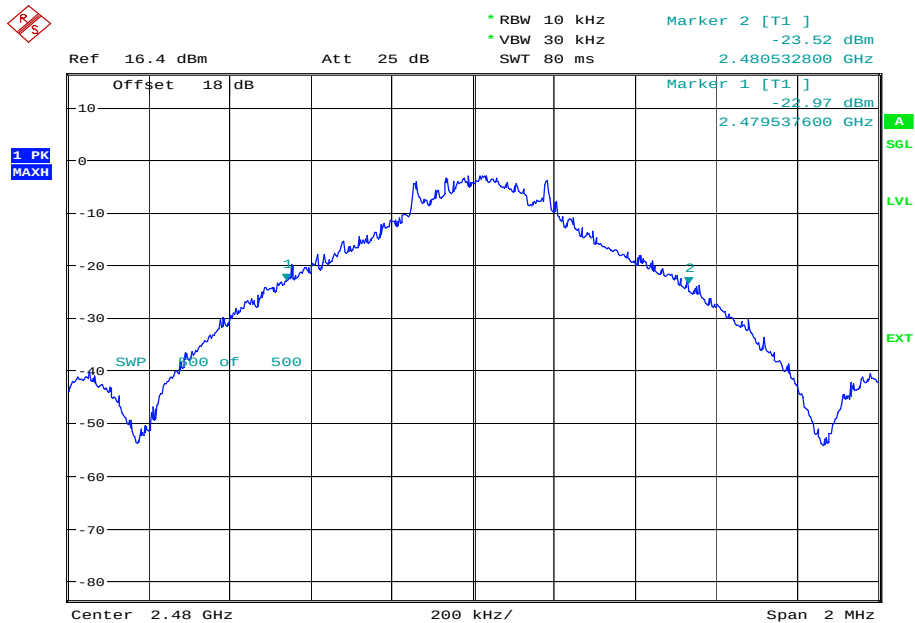
Date: 14.AUG.2012 13:29:40



Product Service

DH3

Date: 14.AUG.2012 13:37:05

DH5

Date: 14.AUG.2012 13:19:16

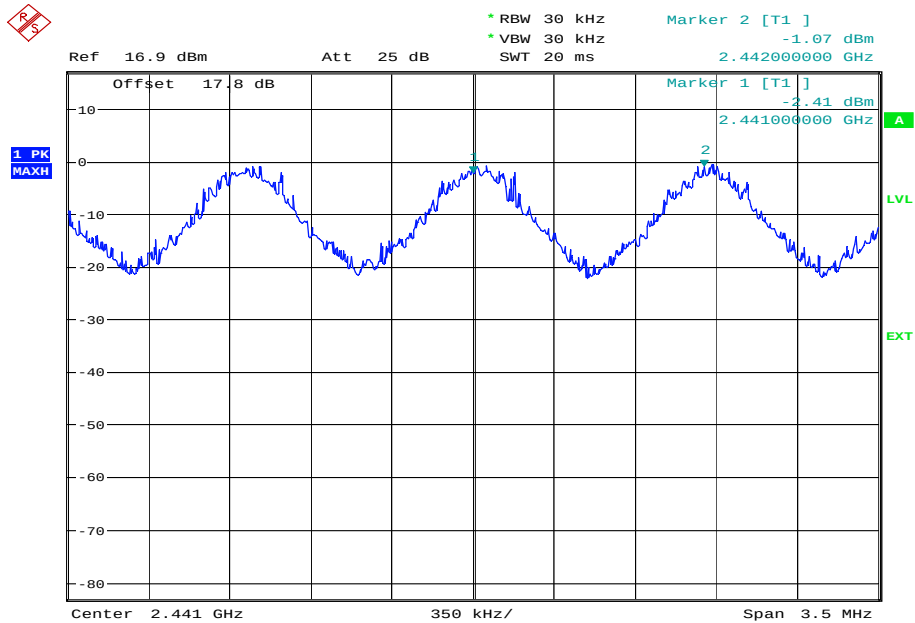
Limit Clause

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



Product Service

Channel Separation



Date: 14.AUG.2012 14:54:19

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.



Product Service

2.3 FREQUENCY HOPPING SYSTEMS - CHANNEL DWELL TIME AND NUMBER OF HOPPING CHANNELS

2.3.1 Specification Reference

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

2.3.2 Equipment Under Test and Modification State

CDMA SHL21 S/N: IMEI004401114094432 - Modification State 0

2.3.3 Date of Test

14 August 2012

2.3.4 Test Equipment Used

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

2.3.5 Test Procedure

DH1

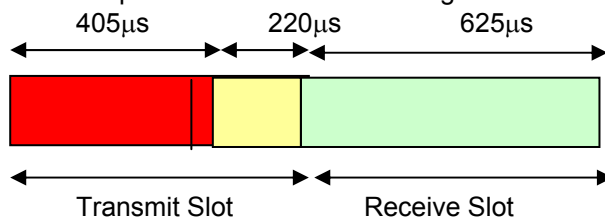
The Bluetooth system hops at a rate of 1600 times per second. Thus, this equates to 1600 timeslots in 1 second.

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

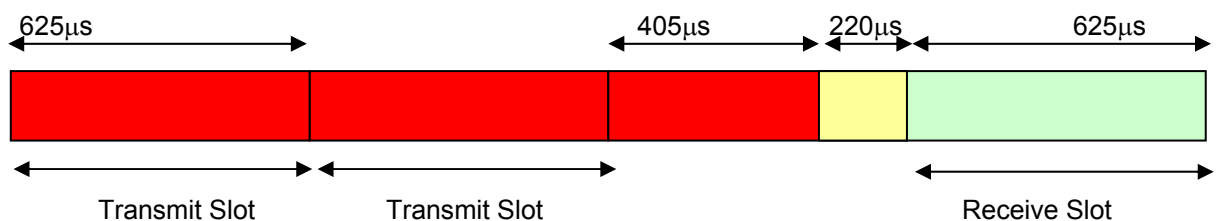
With data rate DH3, the data payload is higher and can use up to 3 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 3 slots, (ie. no receive slot in-between the 3 transmit slots). The $220\mu\text{s}$ off time for synthesizer re-tuning at 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:

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

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

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

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

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

DH5

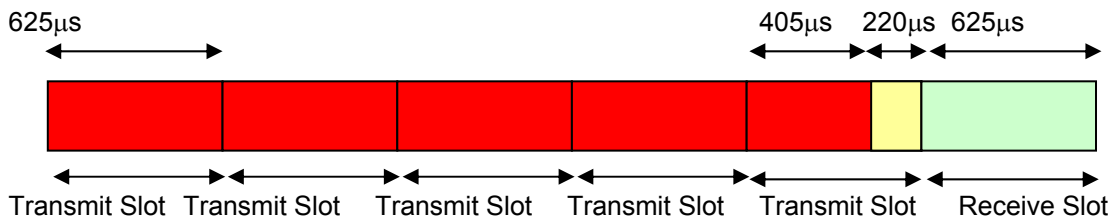
With data rate DH5, the data payload is higher and can use up to 5 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 5 slots, (ie. no receive slot in-between the 5 transmit slots). The 220 μs off time for synthesizer re-tuning at the end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

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 μs . In the fifth transmit slot, 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.





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:

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

So:

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

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

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

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

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

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

2.3.6 Environmental Conditions

Ambient Temperature	24.6°C
Relative Humidity	45.8%



Product Service

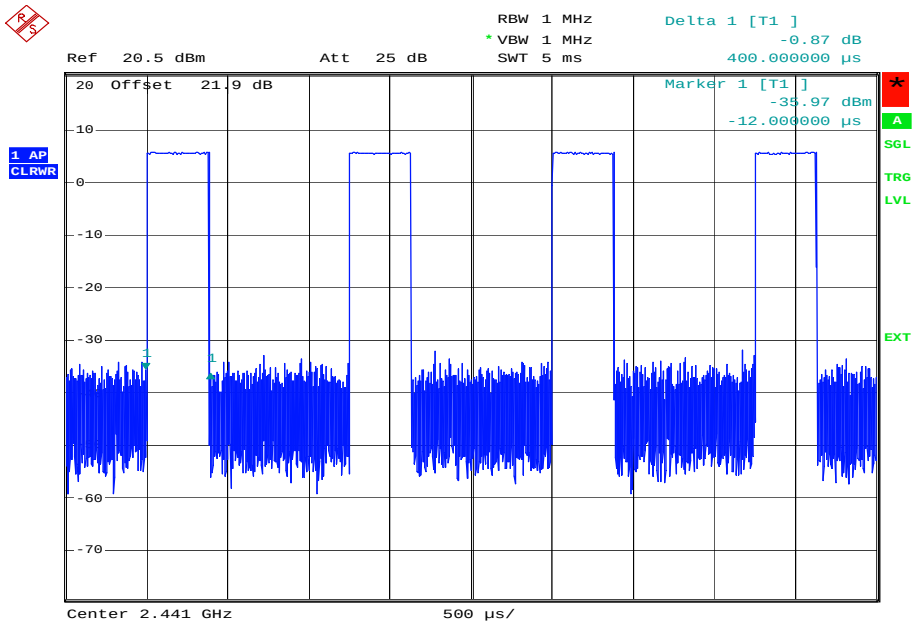
2.3.7 Test Results

4.0 V DC Supply

Channel Dwell Time

DH1

0.4 ms



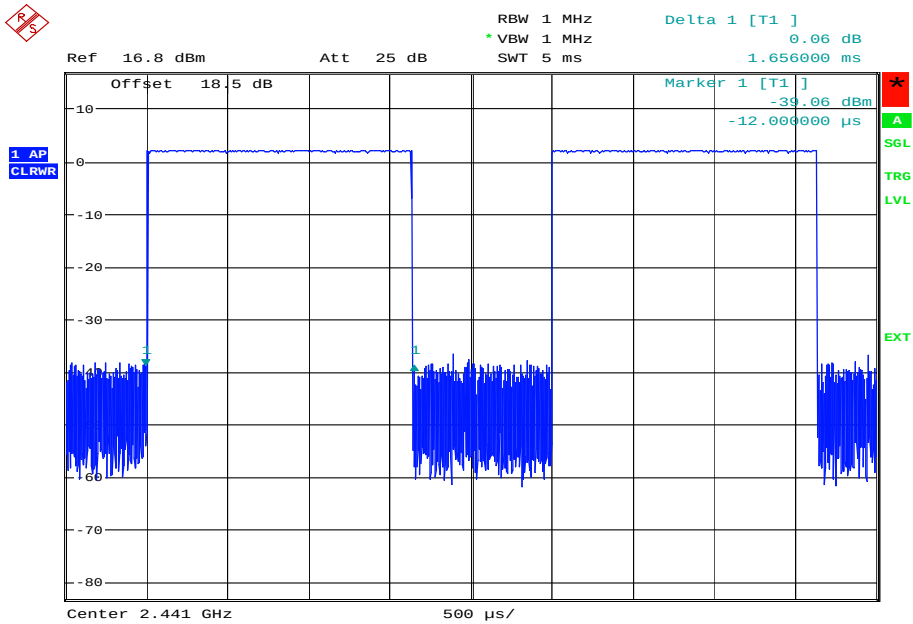
Date: 14.AUG.2012 12:32:55



Product Service

DH3

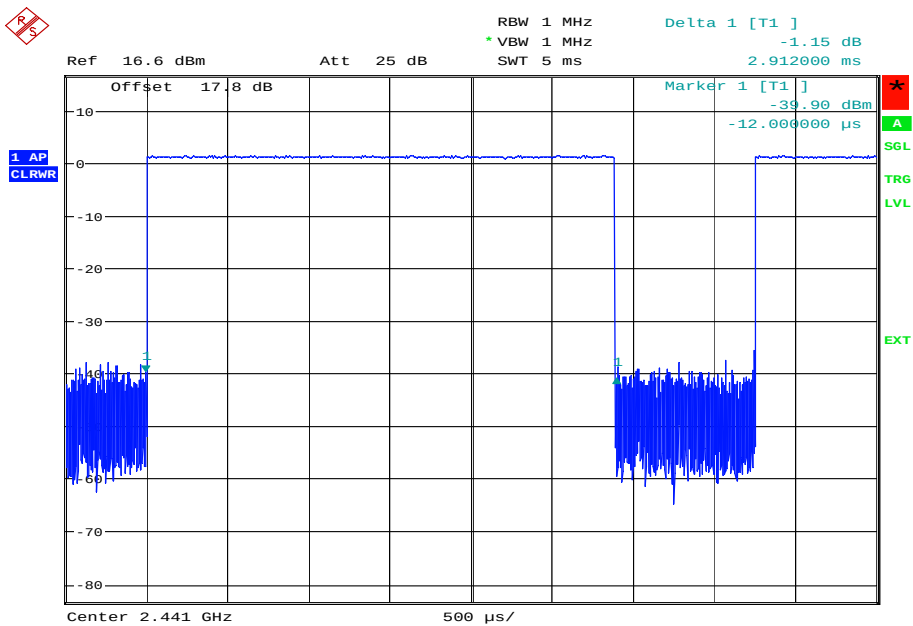
0.4 ms



Date: 14.AUG.2012 12:12:21

DH5

2.912 ms



Date: 14.AUG.2012 12:43:46



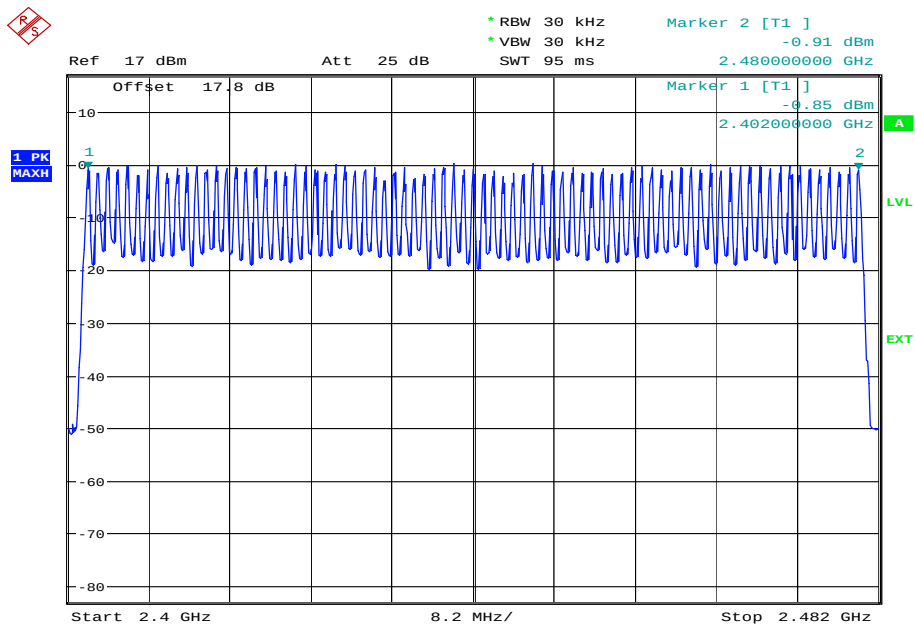
Product Service

Limit

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.

Number of Hopping Channels

79



Date: 14.AUG.2012 12:43:11

Limit

≥ 15 channels



Product Service

2.4 MAXIMUM PEAK CONDUCTED OUTPUT POWER**2.4.1 Specification Reference**

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

2.4.2 Equipment Under Test and Modification State

CDMA SHL21 S/N: IMEI 004401114094432 - Modification State 0

2.4.3 Date of Test

14 August 2012

2.4.4 Test Equipment Used

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

2.4.5 Test Procedure

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.

2.4.6 Environmental Conditions

Ambient Temperature	24.6°C
Relative Humidity	45.8%



2.4.7 Test Results

4.0 V DC Supply

Packet Type	Maximum Peak Conducted Output Power					
	dBm			mW		
	2402 MHz	2441 MHz	2480 MHz	2402 MHz	2441 MHz	2480 MHz
DH1	2.21	1.54	1.75	1.664	1.424	1.494
DH3	2.20	1.61	1.81	1.659	1.448	1.518
DH5	2.28	1.56	1.79	1.689	1.432	1.511

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 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.



Product Service

2.5 EIRP PEAK POWER

2.5.1 Specification Reference

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

2.5.2 Equipment Under Test and Modification State

CDMA SHL21 S/N: IMEI 004401114094630 - Modification State 0

2.5.3 Date of Test

2 September 2012

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 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 and a resolution bandwidth and video bandwidth of 1 MHz were used to perform the measurement. The level on the spectrum analyser was maximised by rotating the EUT 360° and a height search of the measuring antenna. A substitution was then performed using a substitution antenna and signal generator.

This level was maximised by adjusting the height of the measuring antenna once more. The level from the signal generator was then adjusted to achieve the same raw result as with the EUT. This level was then corrected to account for cable loss and antenna factor. If applicable, a peak power analyser was also used to obtain a correction factor for wideband signals such as WLAN.

A calculation was then performed to obtain the final figure.

2.5.6 Environmental Conditions

Ambient Temperature	23.5°C
Relative Humidity	50.0%

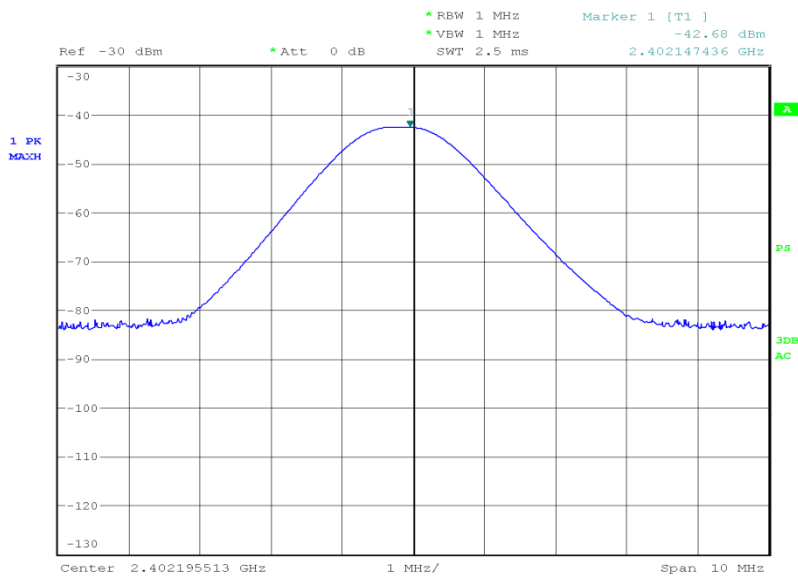


Product Service

2.5.7 Test Results

2402 MHz

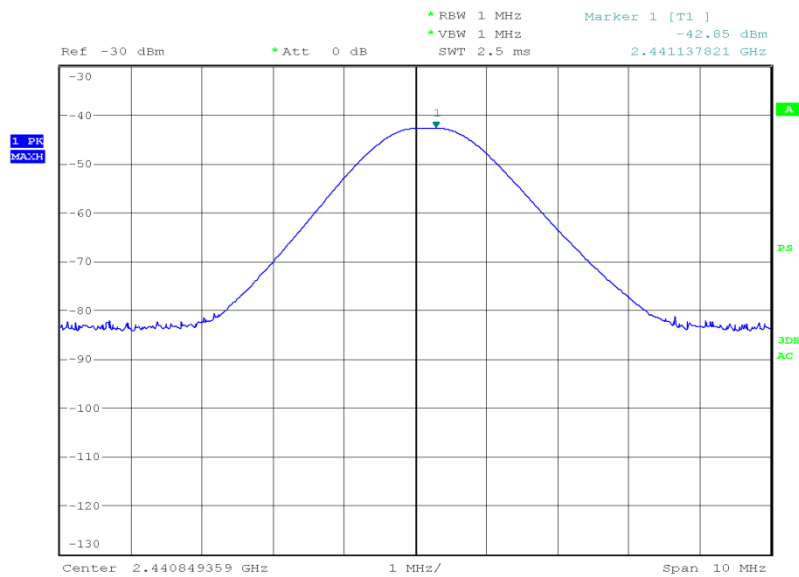
EIRP (dBm)	EIRP (mW)
-1.00	0.794



Date: 2.SEP.2012 09:09:24

2441 MHz

EIRP (dBm)	EIRP (mW)
-0.66	0.859



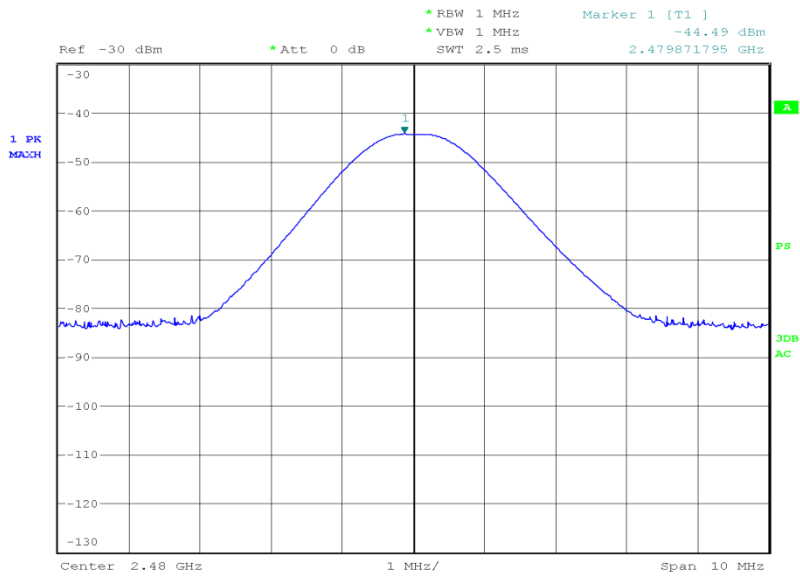
Date: 2.SEP.2012 09:41:01



Product Service

2480 MHz

EIRP (dBm)	EIRP (mW)
-2.37	0.579



Date: 2.SEP.2012 09:51:39

Limit

EIRP (dBm)	EIRP (mW)
36.0	4000



Product Service

2.6 SPURIOUS AND BAND EDGE EMISSIONS

2.6.1 Specification Reference

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

2.6.2 Equipment Under Test and Modification State

CDMA SHL21 S/N: IMEI 004401114094630 - Modification State 0

2.6.3 Date of Test

15 August 2012, 2 September 2012 & 16 September 2012

2.6.4 Test Equipment Used

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

2.6.5 Test Procedure

For conducted emissions, the EUT was set to operate at maximum power on the worst case data rate. The test was performed on the bottom, middle and top channels. The test was performed from 9 kHz to 25 GHz. Firstly, the power of each fundamental frequency was measured in 100 kHz bandwidth and this was used to show a -20 dBc limit line on the trace. The measurement path loss in each relevant frequency band was measured and entered as a reference level offset.

For radiated emissions, the test method described above was also used. However, the measurement was performed from 30 MHz to 25 GHz and the path loss is incorporated as a transducer factor and entered into the spectrum analyser.

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.

2.6.6 Environmental Conditions

Ambient Temperature	18.1 - 24.6°C
Relative Humidity	45.8 - 56.0%



Product Service

2.6.7 Test Results

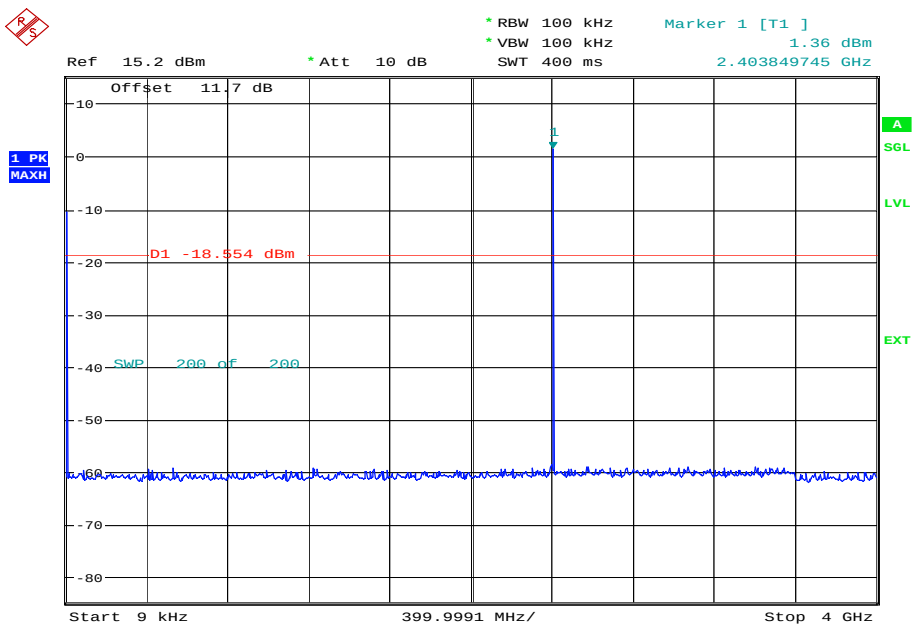
4.0 V DC Supply

Spurious Conducted Emissions

DH5

2402 MHz

9 kHz to 4 GHz

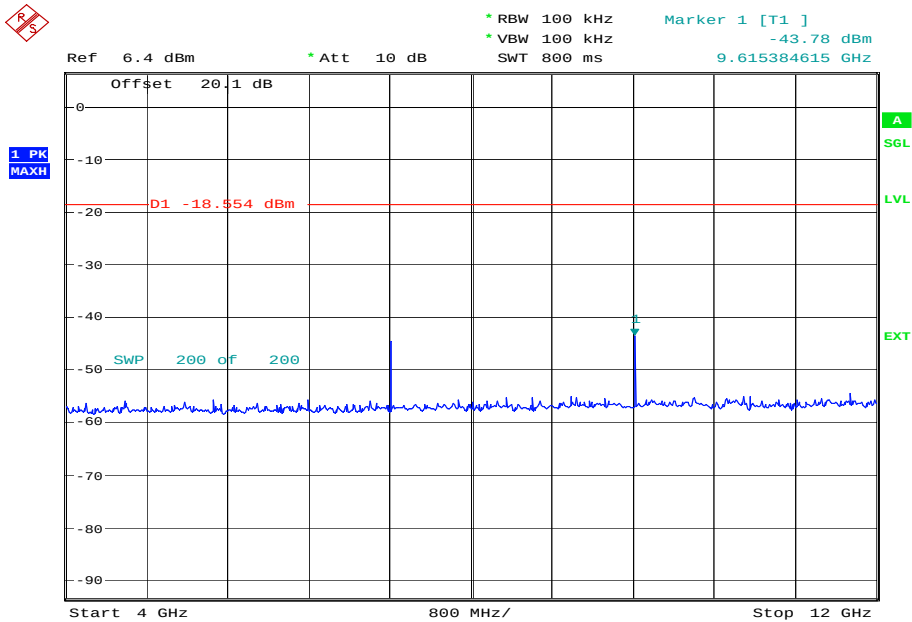


Date: 15.AUG.2012 11:12:01



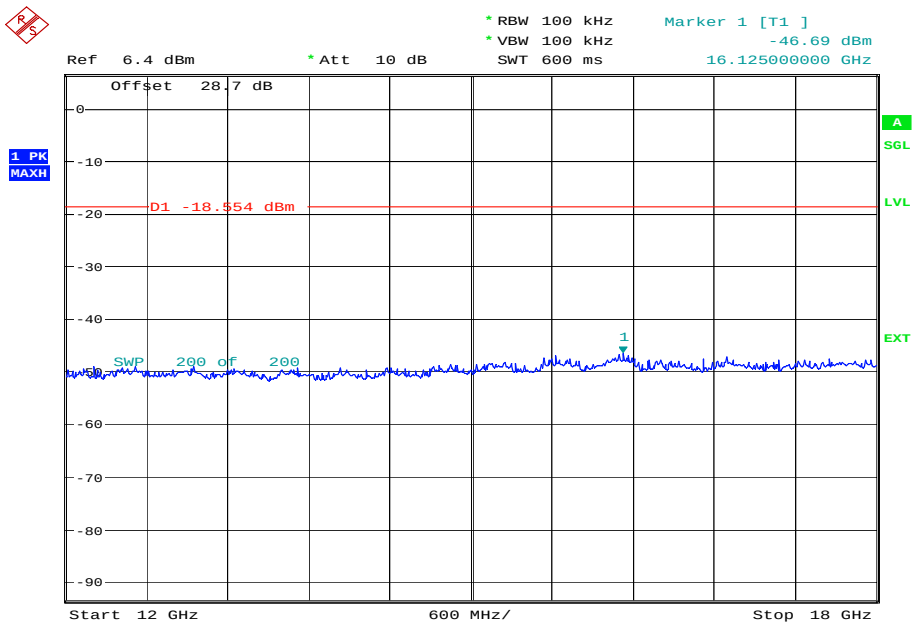
Product Service

4 GHz to 12 GHz



Date: 15.AUG.2012 11:19:35

12 GHz to 18 GHz

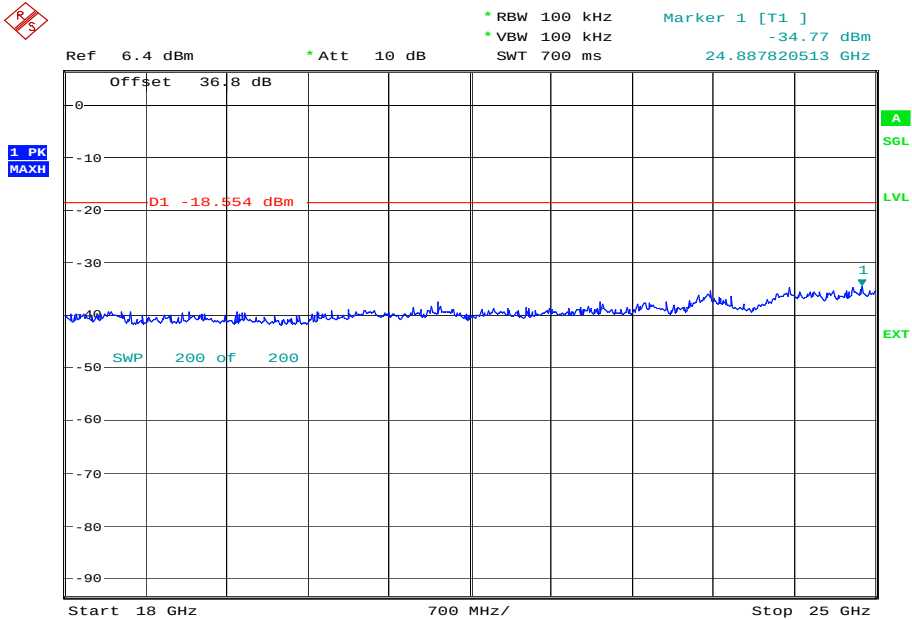


Date: 15.AUG.2012 11:22:04



Product Service

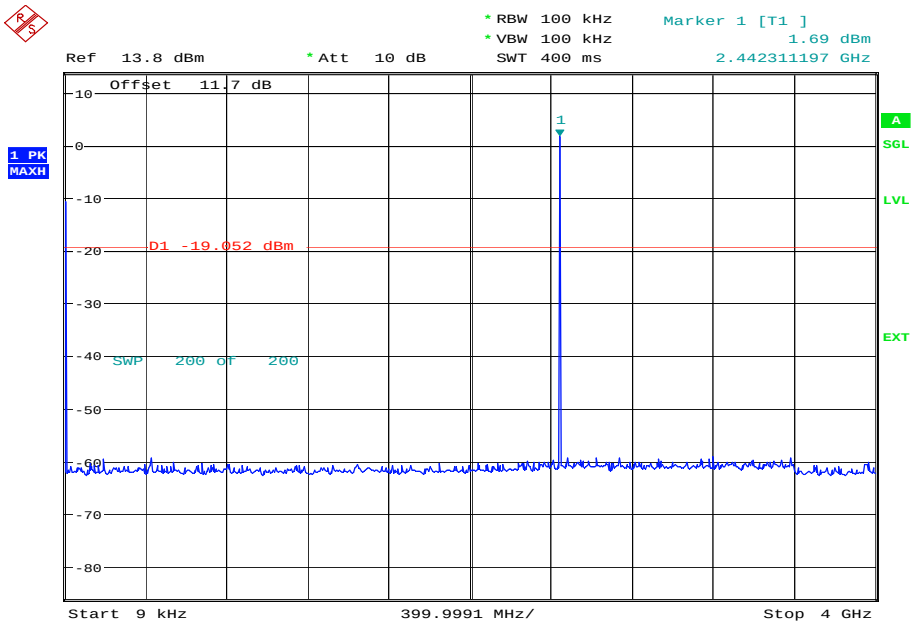
18 GHz to 25 GHz



Date: 15.AUG.2012 11:53:11

2441 MHz

9 kHz to 4 GHz

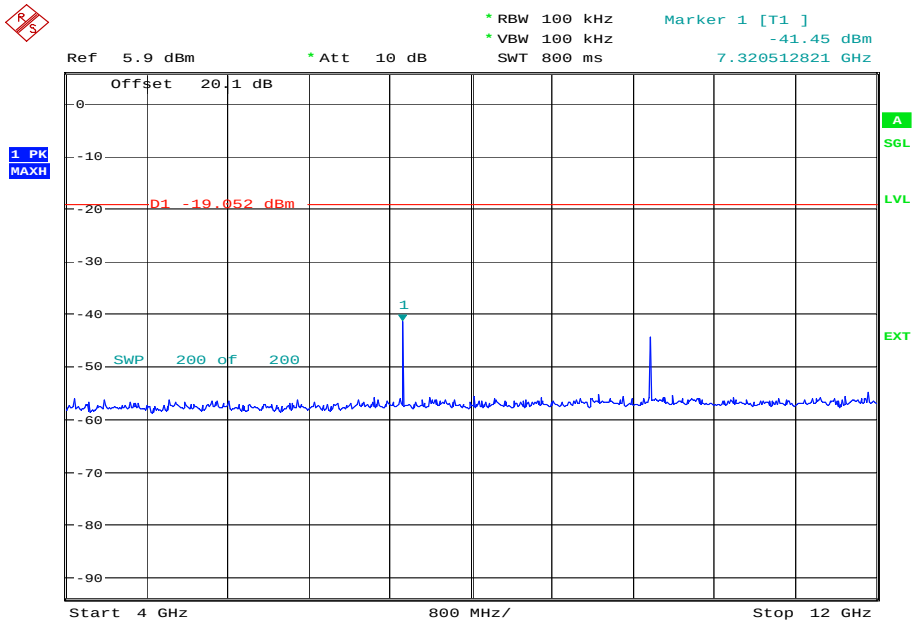


Date: 15.AUG.2012 11:07:40



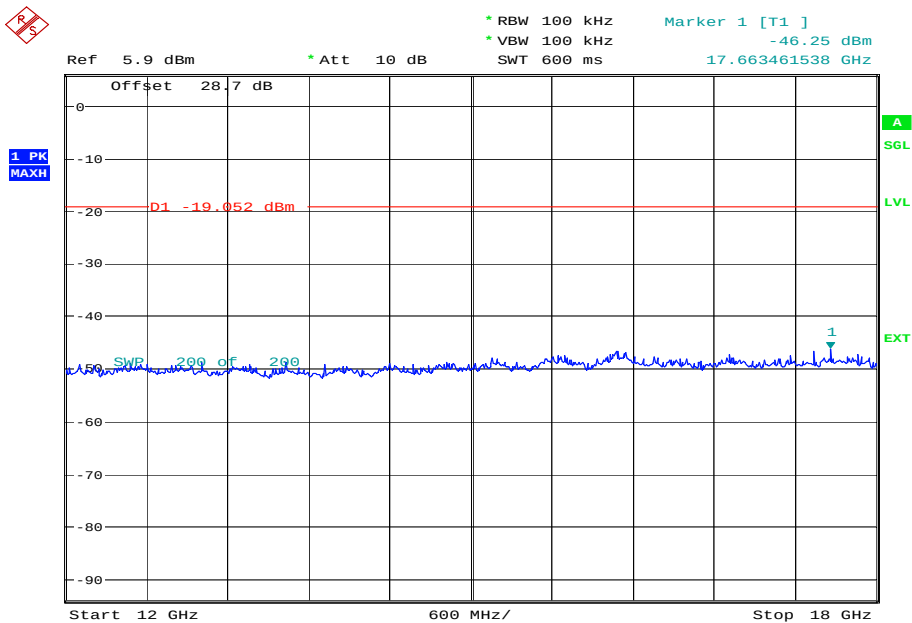
Product Service

4 GHz to 12 GHz



Date: 15.AUG.2012 11:30:56

12 GHz to 18 GHz

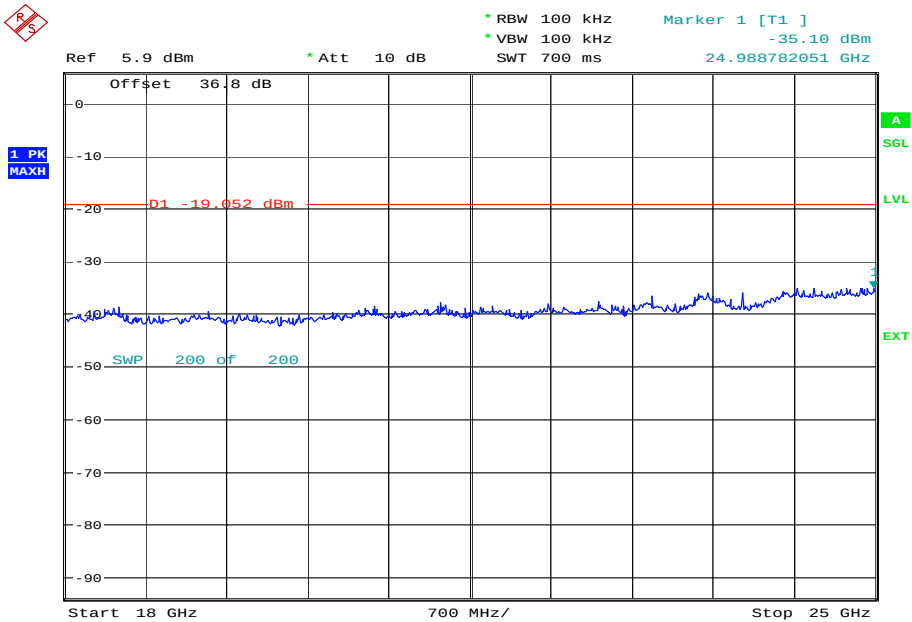


Date: 15.AUG.2012 11:34:54



Product Service

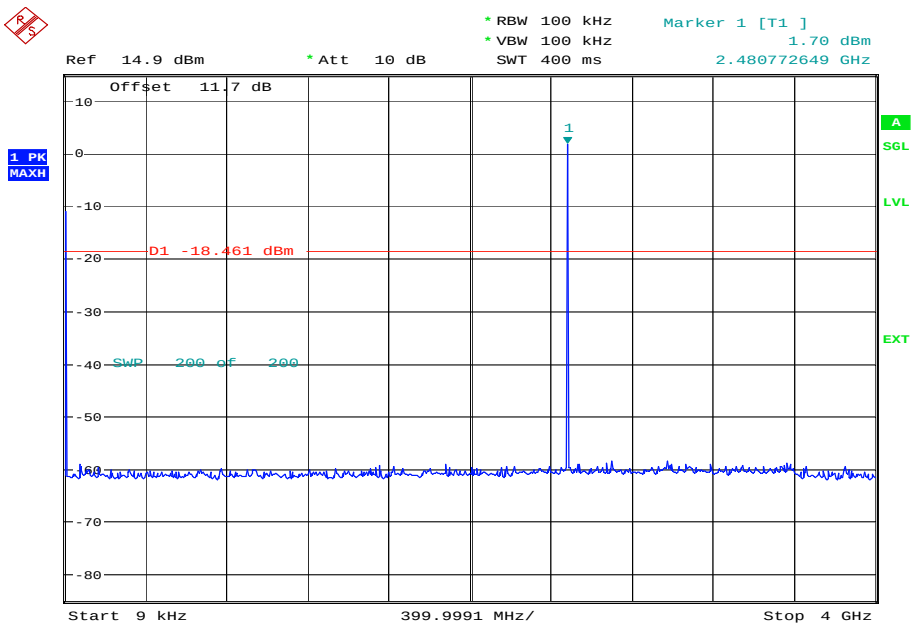
18 GHz to 25 GHz



Date: 15.AUG.2012 11:49:09

2480 MHz

9 kHz to 4 GHz

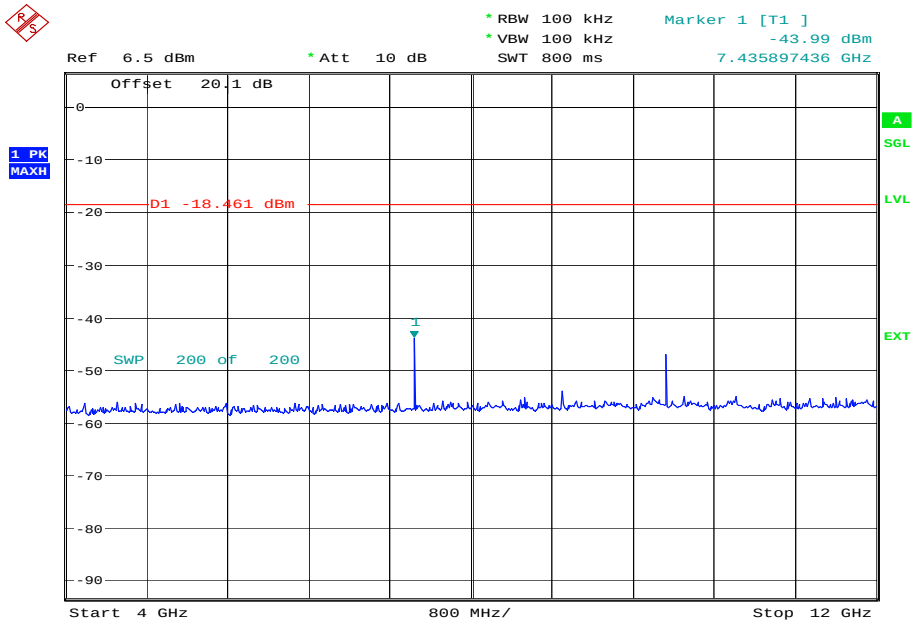


Date: 15.AUG.2012 10:42:45



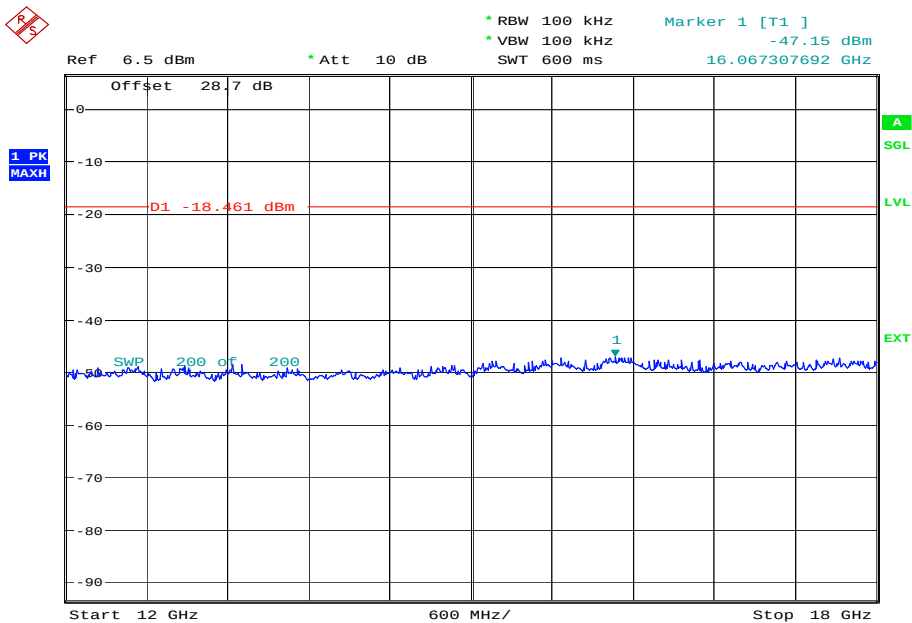
Product Service

4 GHz to 12 GHz



Date: 15.AUG.2012 11:38:39

12 GHz to 18 GHz

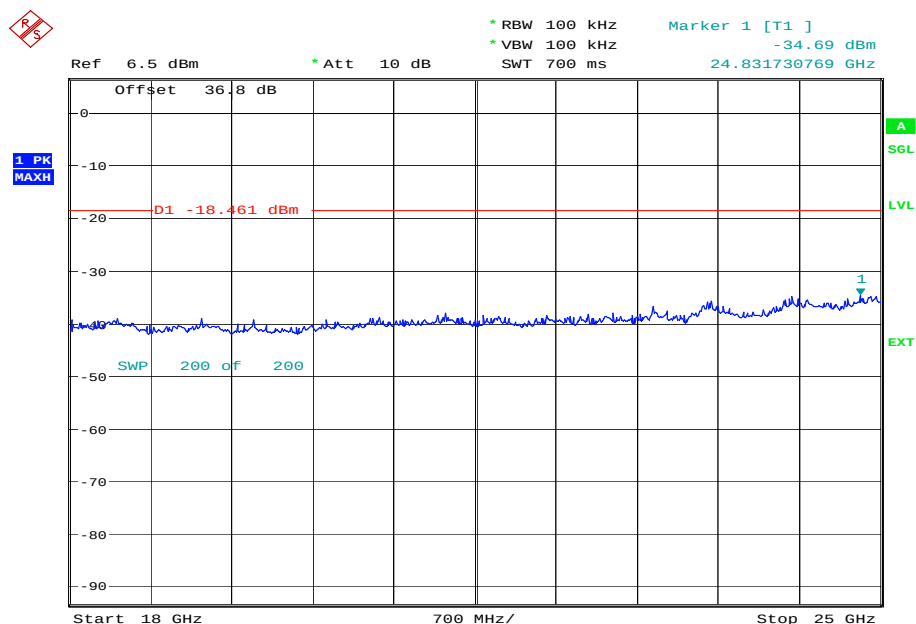


Date: 15.AUG.2012 11:41:09



Product Service

18 GHz to 25 GHz



Date: 15.AUG.2012 11:45:58

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.

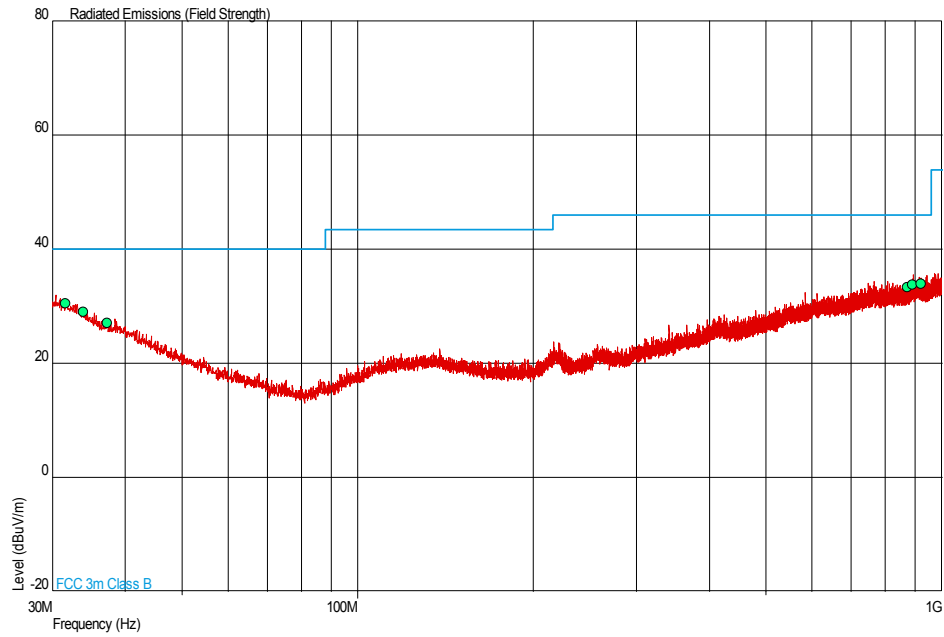


Product Service

Spurious Radiated Emissions

2402 MHz

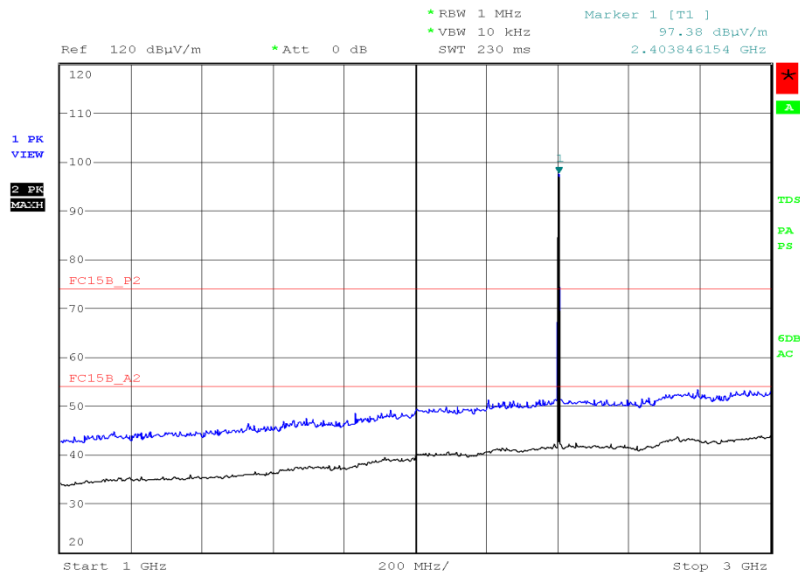
30 MHz to 1 GHz



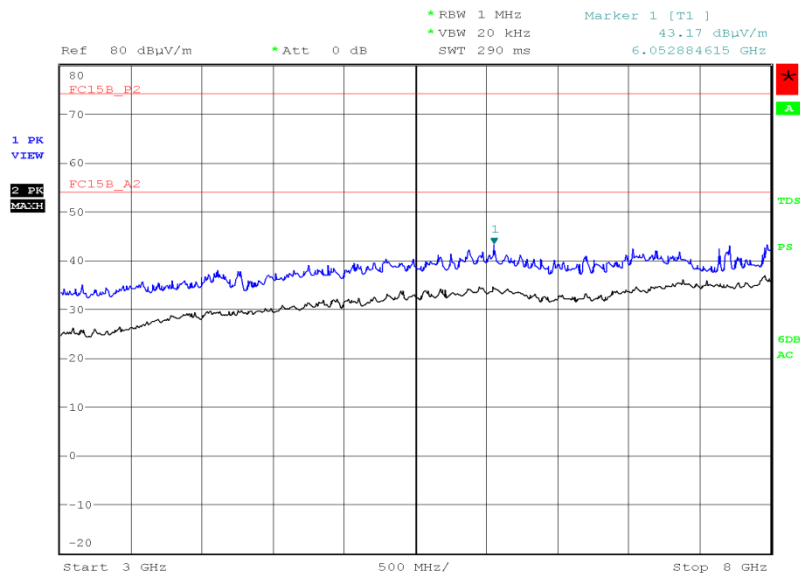
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity	
31.570	30.6	33.9	40.0	100	-9.4	66.1	0	0.00	Horizontal	
33.929	29.0	28.2	40.0	100	-11.0	71.8	135	1.00	Vertical	
37.275	27.1	22.6	40.0	100	-12.9	77.4	180	1.00	Vertical	
873.367	33.3	46.2	46.0	200	-12.7	153.8	270	1.00	Horizontal	
891.700	33.9	49.5	46.0	200	-12.1	150.5	0	1.00	Vertical	
919.878	33.9	49.5	46.0	200	-12.1	150.5	270	1.00	Vertical	



Product Service

1 GHz to 3 GHz

Date: 2.SEP.2012 09:19:23

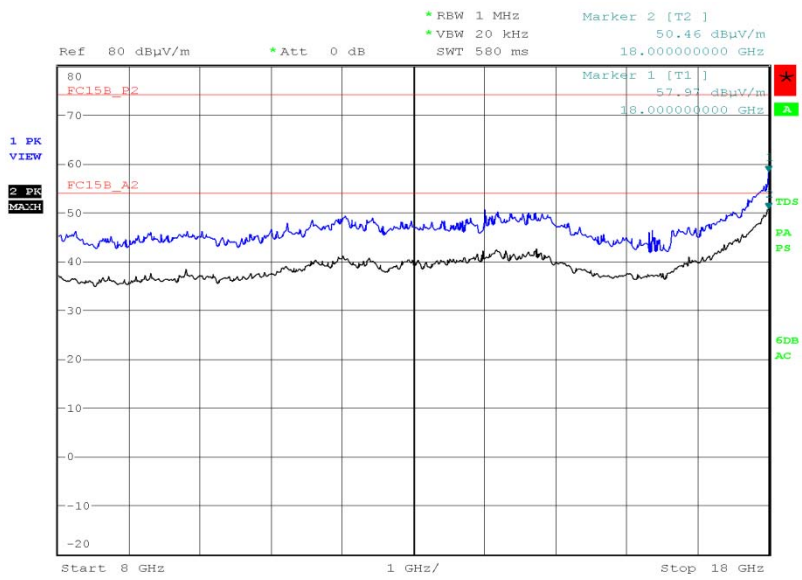
3 GHz to 8 GHz

Date: 2.SEP.2012 11:01:21



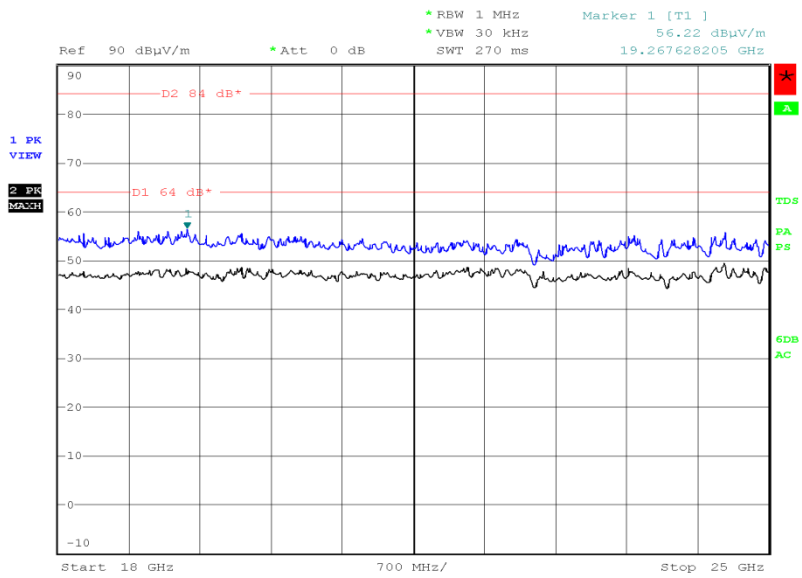
Product Service

8 GHz to 18 GHz



Date: 2.SEP.2012 15:10:58

18 GHz to 25 GHz



Date: 16.SEP.2012 15:27:41

Limit

Peak (dBμV/m)	Average (dBμV/m)
74.0	54.0

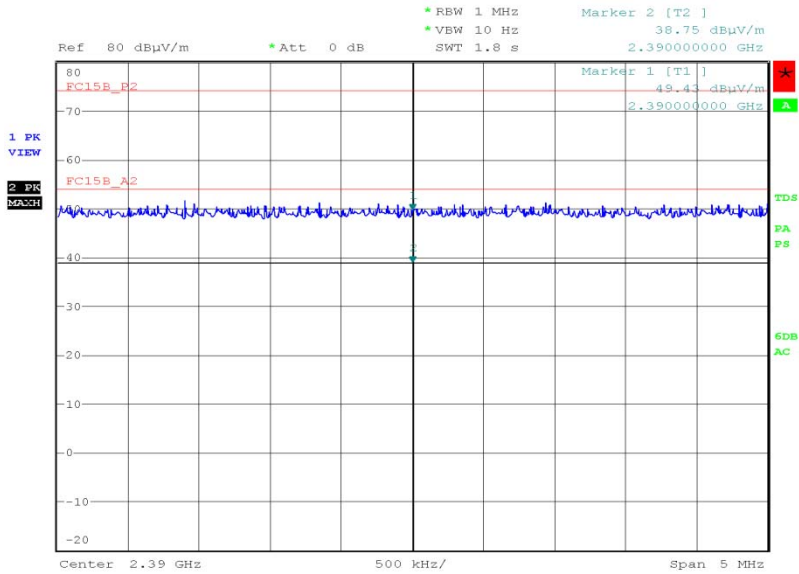


Product Service

Band Edge Emissions

2402 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Horizontal	49.43	38.75



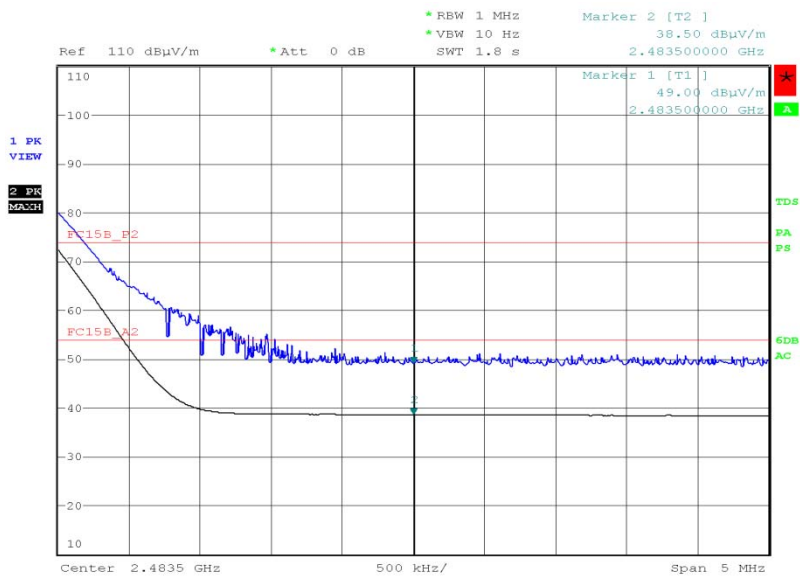
Date: 2.SEP.2012 09:13:12



Product Service

2480 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Horizontal	49.00	38.50



Date: 2.SEP.2012 09:56:45

Limit

Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0



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 – AC Line Conducted Emissions					
Transient Limiter	Hewlett Packard	11947A	15	12	1-Dec-2012
3 phase LISN	Rohde & Schwarz	ESH2-Z5	323	12	13-Jan-2013
LISN (1 Phase)	Chase	MN 2050	336	12	23-Mar-2013
Transient Limiter	Hewlett Packard	11947A	1032	12	28-Jun-2013
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	29-Sep-2012
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
Section 2.2 - Frequency Hopping Systems - 20dB Bandwidth and Channel Separation					
Power Meter	Rohde & Schwarz	NRV	52	-	TU
True RMS Multimeter	Fluke	79 Series III	411	12	25-Jul-2013
RF Coupler	TUV SUD Product Service	TÜV	415	-	TU
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	21-Sep-2012
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	19-Jan-2013
Programmable Power Supply	Iso-tech	IPS 2010	2438	-	O/P Mon
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	18-Nov-2012
Hygrometer	Rotronic	I-1000	2891	12	21-May-2013
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	20-Dec-2012
Combiner/Splitter	Weinschel	1506A	3879	12	19-Mar-2013
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	27-Jun-2013
P-Series Power Meter	Agilent	N1911A	3980	12	12-Sep-2012
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3982	12	12-Sep-2012
Section 2.3 - Frequency Hopping Systems - Channel Dwell Time and Number of Hopping Channels					
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	19-Jan-2013
Programmable Power Supply	Iso-tech	IPS 2010	2438	-	O/P Mon
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	18-Nov-2012
Hygrometer	Rotronic	I-1000	2891	12	21-May-2013
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	20-Dec-2012
Combiner/Splitter	Weinschel	1506A	3879	12	19-Mar-2013
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	27-Jun-2013
P-Series Power Meter	Agilent	N1911A	3980	12	12-Sep-2012
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3982	12	12-Sep-2012



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.4 - Maximum Peak Conducted Output Power					
Signal Generator	Marconi	2031	53	-	O/P Mon
True RMS Multimeter	Fluke	79 Series III	411	12	25-Jul-2013
Multimeter	Fluke	75 Mk3	455	12	16-Jan-2013
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	27-Jun-2013
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	21-Sep-2012
Power Splitter	Weinschel	1506A	606	12	19-Dec-2012
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	19-Jan-2013
Programmable Power Supply	Iso-tech	IPS 2010	2438	-	O/P Mon
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	18-Nov-2012
Hygrometer	Rotronic	I-1000	2891	12	21-May-2013
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	14-Jun-2013
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	20-Dec-2012
Signal Generator, 9kHz - 3GHz	Rohde & Schwarz	SMA 100A	3504	12	19-Aug-2012
'3.5mm' - '3.5mm' RF Cable (1m)	Rhophase	3PS-1803-1000-3PS	3697	12	27-Jan-2013
'N' - 'N' RF Cable (1m)	Rhophase	NPS-1803-1000-NPS	3700	12	12-Jan-2013
Combiner/Splitter	Weinschel	1506A	3879	12	19-Mar-2013
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	27-Jun-2013
P-Series Power Meter	Agilent	N1911A	3980	12	12-Sep-2012
P-Series Power Meter	Agilent	N1911A	3981	12	12-Sep-2012
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3982	12	12-Sep-2012
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3983	12	12-Sep-2012



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.5 - EIRP Peak Power					
Peak Power Analyser	Hewlett Packard	8990A	107	12	10-Feb-2013
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	8-Dec-2012
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	14-Nov-2012
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
Signal Generator (1GHz to 40GHz)	Rohde & Schwarz	SMR40	1589	12	11-Nov-2012
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Power Sensor	Hewlett Packard	84812A	2743	-	TU
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	18-Nov-2012
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3159	12	13-Jun-2013
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	30-Aug-2013
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	20-Dec-2012
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	29-Sep-2012
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	27-Jan-2013
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
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	4144	12	01-May-2013



Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6 - Spurious and Band Edge Emissions					
Signal Generator	Rohde & Schwarz	SMX	185	-	O/P Mon
Antenna (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	13-Sep-2013
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	14-Nov-2012
True RMS Multimeter	Fluke	79 Series III	411	12	25-Jul-2013
Multimeter	Fluke	75 Mk3	455	12	16-Jan-2013
Attenuator (10dB, 10W)	Weinschel	23-10-34	470	12	27-Jun-2013
Filter (High Pass)	Lorch	SHP7-7000-SR	566	12	20-Feb-2013
Broadband Resistive Power Divider	Weinschel	1506A	605	12	6-Sep-2012
Power Splitter	Weinschel	1506A	606	12	19-Dec-2012
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	19-Jan-2013
Antenna (Double Ridge Guide)	Q-Par Angus Ltd	QSH 180K	1511	-	TU
Pre-Amplifier	Phase One	PS04-0086	1533	12	20-Sep-2012
Pre-Amplifier	Phase One	PSO4-0087	1534	12	26-Sep-2012
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
Signal Generator (1GHz to 40GHz)	Rohde & Schwarz	SMR40	1589	12	11-Nov-2012
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Programmable Power Supply	Iso-tech	IPS 2010	2438	-	O/P Mon
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	18-Nov-2012
High Pass Filter (4GHz)	RLC Electronics	F-100-4000-5-R	2773	12	20-Sep-2012
Filter	Daden Anthony Ass	MH-1500-7SS	2778	12	21-Dec-2012
Hygrometer	Rotronic	I-1000	2891	12	21-May-2013
Antenna (Bilog)	Chase	CBL6143	2904	24	12-May-2013
Attenuator (10dB, 2W)	Weinschel	1	3030	-	TU
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	27-Jun-2013
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	30-Aug-2013
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	12	14-Jun-2013
High Pass Filter (3GHz)	RLC Electronics	F-100-3000-5-R	3349	12	29-May-2013
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	20-Dec-2012
Signal Generator, 9kHz - 3GHz	Rohde & Schwarz	SMA 100A	3504	12	19-Aug-2012
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	29-Sep-2012
3 GHz High Pass Filter	K&L Microwave	11SH10-3000/X18000-O/O	3552	12	16-Apr-2013
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
'2.92mm' - '2.92mm' RF Cable (2m)	Rhophase	KPS-1503-2000-KPS	3694	-	TU
'2.92mm' - '2.92mm' RF Cable (2m)	Rhophase	KPS-1503-2000-KPS	3695	-	TU



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6 - Spurious and Band Edge Emissions					
'3.5mm' - '3.5mm' RF Cable (1m)	Rhophase	3PS-1803-1000-3PS	3697	12	27-Jan-2013
'N' - 'N' RF Cable (1m)	Rhophase	NPS-1803-1000-NPS	3700	12	12-Jan-2013
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	27-Jan-2013
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Combiner/Splitter	Weinschel	1506A	3879	12	19-Mar-2013
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Low Noise Amplifier	Wright Technologies	APS04-0085	3969	-	O/P Mon
P-Series Power Meter	Agilent	N1911A	3980	12	12-Sep-2012
P-Series Power Meter	Agilent	N1911A	3981	12	12-Sep-2012
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3982	12	12-Sep-2012
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3983	12	12-Sep-2012
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	4144		Class 1 (Int)

TU – Traceability Unscheduled

O/P MON – Output Monitored with Calibrated Equipment



3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	MU
Frequency Hopping Systems - Channel Dwell Time and Number of Hopping Channels	-
Frequency Hopping Systems - 20dB Bandwidth and Channel Separation	± 16.74 kHz
EIRP Peak Power	30MHz to 1GHz: ± 5.1 dB 1GHz to 40GHz: ± 6.3 dB
Maximum Peak Conducted Output Power	± 0.70 dB
Spurious and Band Edge Emissions	30MHz to 1GHz: ± 5.1 dB 1GHz to 40GHz: ± 6.3 dB
AC Line Conducted Emissions	± 3.2 dB



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
(Not UKAS Accredited).

This report must not be reproduced, except in its entirety, without the written permission of
TÜV SÜD Product Service Limited

© 2012 TÜV SÜD Product Service Limited