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Report On

FCC and Industry Canada Testing of the
Inmarsat Global Ltd IsatPhone Pro GMR2+ Satellite Phone

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FCC ID: YCTISATPHONE
IC ID: 8944A-ISATPHONE

Document 75909459 Report 07 Issue 1

June 2010



Product Service

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Inmarsat Global Ltd IsatPhone Pro GMR2+ Satellite Phone


Document 75909459 Report 07 Issue 1

June 2010

PREPARED FOR


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DATED

11 June 2010

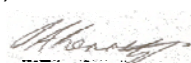
ENGINEERING STATEMENT

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 25, Part 2 and RSS-170. The sample tested was found to comply with the requirements defined in the applied rules.

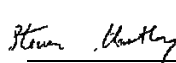
Test Engineer(s);



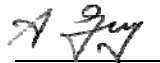
M P Hardy




S Bennet




S Hartley



A Guy



G Lawler



J Holcombe





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SECTION 1

REPORT SUMMARY

FCC and Industry Canada Testing of the
Inmarsat Global Ltd IsatPhone Pro GMR2+ Satellite Phone



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Inmarsat Global Ltd, IsatPhone Pro GMR2+ Satellite Phone to the requirements of FCC CFR 47 Part 25 and Part 2 and RSS-170.

Objective	To perform FCC and Industry Canada Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Inmarsat Global Ltd
Model Number(s)	IsatPhone Pro GMR2+ Satellite Phone
Serial Number(s)	IMEI: 004401510018258 IMEI: 004401510018217 IMEI: 004401510018183 IMEI: 004401510018340
Software Version	V0.3.9_P6
Hardware Version	0321
Number of Samples Tested	4
Test Specification/Issue/Date	FCC CFR 47 Part 25: 2009 FCC CFR 47 Part 2: 2009 RSS-170: Issue 1: 1999
Incoming Release Date	Declaration of Build Status 02 June 2010
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	3100003117 29 March 2010
Start of Test	26 April 2010
Finish of Test	03 June 2010
Name of Engineer(s)	M P Hardy S Bennett S Hartley A Guy G Lawler J Holcombe
Related Document(s)	ANSI C63.4: 2003



Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results for each configuration, in accordance with FCC CFR 47 Part 25 and Part 2 and RSS-170 is shown below.

Configuration 1 – Mobile Handset + SHF								
Section	Spec Clause			Test Description	Mode	Mod State	Result	Base Standard
	FCC		IC					
	Part 25	Part 2						
2.1	25.202 (f)(3)	2.1053	Annex B: B3	Spurious Emissions (Radiated)	Carrier On	0	Pass	ANSI C63.4
2.2	25.204	2.1046	Annex B: B1	EIRP Peak Power	Carrier On	0	Pass	ANSI C63.4
2.3	25.202 (f)(3)	-	-	Spurious Emissions (Conducted)	Carrier On	0	Pass	ANSI C63.4
2.4	25.216(h)	-	-	Spurious Emissions (Conducted)	Carrier On	0	Pass	ANSI C63.4
	25.216(i)	-	-	Spurious Emissions (Conducted)	Carrier On		N/A	
2.6	-	-	Annex B: B2	Spurious Emissions	Carrier On	0	Pass	ANSI C63.4
2.7	-	-	Annex B: B2	Emission Mask	Carrier On	0	Pass	ANSI C63.4
2.8	25.202 (f)(1)(2)	2.1051	-	Emission Mask	Carrier On	0	Pass	ANSI C63.4
2.9	-	2.1049	6.3	Occupied Bandwidth	Carrier On	0	Pass	ANSI C63.4
2.10	25.202(d)	2.1055	Annex B: B5	Frequency Tolerance / Frequency Stability	Carrier On	0	Pass	ANSI C63.4
2.11	25.201	2.1046	Annex B: B1	Power and Antenna Height Limits	Carrier On	0	Pass	ANSI C63.4
2.12	-	2.1047	-	Modulation Characteristics	Carrier On	0	Pass	



Product Service

Configuration 2 - Mobile Handset + AC Charger + SHF								
Section	Spec Clause			Test Description	Mode	Mod State	Result	Base Standard
	FCC		IC					
	Part 25	Part 2						
2.1	25.202 (f)(3)	2.1053	Annex B: B3	Spurious Emissions (Radiated)	Carrier On	0	Pass	ANSI C63.4
2.2	25.204	2.1046	Annex B: B1	EIRP Peak Power	Carrier On	0	Pass	ANSI C63.4
	25.202 (f)(3)	-	-	Spurious Emissions (Conducted)	Carrier On		N/A	ANSI C63.4
	25.216(h)	-	-	Spurious Emissions (Conducted)	Carrier On		N/A	
2.5	25.216(i)	-	-	Spurious Emissions (Conducted)	Carrier On	0	Pass	ANSI C63.4
	-	-	Annex B: B2	Spurious Emissions	Carrier On		N/A	ANSI C63.4
	-	-	Annex B: B2	Emission Mask	Carrier On		N/A	ANSI C63.4
	25.202 (f)(1)(2)	2.1051	-	Emission Mask	Carrier On		N/A	ANSI C63.4
	-	2.1049	6.3	Occupied Bandwidth	Carrier On		N/A	ANSI C63.4
	25.202(d)	2.1055	Annex B: B5	Frequency Tolerance / Frequency Stability	Carrier On		N/A	ANSI C63.4
	25.201	2.1046	Annex B: B1	Power and Antenna Height Limits	Carrier On		N/A	ANSI C63.4
	-	2.1047	-	Modulation Characteristics	Carrier On		N/A	



Product Service

Configuration 3 – Mobile Handset + USB + SHF								
Section	Spec Clause			Test Description	Mode	Mod State	Result	Base Standard
	FCC		IC					
	Part 25	Part 2						
2.1	25.202 (f)(3)	2.1053	Annex B: B3	Spurious Emissions (Radiated)	Carrier On	0	Pass	ANSI C63.4
2.2	25.204	2.1046	Annex B: B1	EIRP Peak Power	Carrier On	0	Pass	ANSI C63.4
	25.202 (f)(3)	-	-	Spurious Emissions (Conducted)	Carrier On		N/A	ANSI C63.4
	25.216(h)	-	-	Spurious Emissions (Conducted)	Carrier On		N/A	
	25.216(i)	-	-	Spurious Emissions (Conducted)	Carrier On		N/A	
	-	-	Annex B: B2	Spurious Emissions	Carrier On		N/A	ANSI C63.4
	-	-	Annex B: B2	Emission Mask	Carrier On		N/A	ANSI C63.4
	25.202 (f)(1)(2)	2.1051	-	Emission Mask	Carrier On		N/A	ANSI C63.4
	-	2.1049	6.3	Occupied Bandwidth	Carrier On		N/A	ANSI C63.4
	25.202(d)	2.1055	Annex B: B5	Frequency Tolerance / Frequency Stability	Carrier On		N/A	ANSI C63.4
	25.201	2.1046	Annex B: B1	Power and Antenna Height Limits	Carrier On		N/A	ANSI C63.4
	-	2.1047	-	Modulation Characteristics	Carrier On		N/A	



Product Service

Configuration 4 - Mobile Handset + DC Charger								
Section	Spec Clause			Test Description	Mode	Mod State	Result	Base Standard
	FCC		IC					
	Part 25	Part 2						
2.1	25.202 (f)(3)	2.1053	Annex B: B3	Spurious Emissions (Radiated)	Carrier On	0	Pass	ANSI C63.4
2.2	25.204	2.1046	Annex B: B1	EIRP Peak Power	Carrier On	0	Pass	ANSI C63.4
	25.202 (f)(3)	-	-	Spurious Emissions (Conducted)	Carrier On		N/A	ANSI C63.4
	25.216(h)	-	-	Spurious Emissions (Conducted)	Carrier On		N/A	
	25.216(i)	-	-	Spurious Emissions (Conducted)	Carrier On		N/A	
	-	-	Annex B: B2	Spurious Emissions	Carrier On		N/A	ANSI C63.4
	-	-	Annex B: B2	Emission Mask	Carrier On		N/A	ANSI C63.4
	25.202 (f)(1)(2)	2.1051	-	Emission Mask	Carrier On		N/A	ANSI C63.4
	-	2.1049	6.3	Occupied Bandwidth	Carrier On		N/A	ANSI C63.4
	25.202(d)	2.1055	Annex B: B5	Frequency Tolerance / Frequency Stability	Carrier On		N/A	ANSI C63.4
	25.201	2.1046	Annex B: B1	Power and Antenna Height Limits	Carrier On		N/A	ANSI C63.4
	-	2.1047	-	Modulation Characteristics	Carrier On		N/A	

N/A – Not Applicable



1.3 DECLARATION OF BUILD STATUS

MAIN EUT		
MANUFACTURING DESCRIPTION	IsatPhone Pro GMR2+ Satellite Phone	
MANUFACTURER	Inmarsat	
TYPE	IsatPhone Pro	
PART NUMBER	NA	
SERIAL NUMBER	004401510018092 004401510018183 004401510018167 004401510018258 - HWID: 0321 Rx Modification Fitted 004401510018217 - HWID: 0321 Rx Modification Fitted 004401510021666 004401510019736	
HARDWARE VERSION	0321	
SOFTWARE VERSION	V0.3.9_P6	
TRANSMITTER OPERATING RANGE	GMR 2+ 1626.5 – 1660.5 1668 - 1675MHz BT 2402 – 2480 MHz	
RECEIVER OPERATING RANGE	GMR2+ 1518 – 1559 MHz BT 2402 – 2480 MHz GPS 1575.42MHz	
INTERMEDIATE FREQUENCIES	110.592 MHz	
EMISSION DESIGNATOR(S): (i.e. G1D, GXW)	G1D	
MODULATION TYPES: (i.e. GMSK, QPSK)	GMR 2+ TX: GMSK RX:OQPSK	
HIGHEST INTERNALLY GENERATED FREQUENCY	3350MHz	
HIGHEST INTERNALLY GENERATED FREQUENCY IN RECEIVE IDLE MODE	3118MHz	
OUTPUT POWER (W or dBm)	GMR2+ +33.5dBm BT +3.8dBm	
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	GMR2+ Satellite Phone for Inmarsat satellite network system	
If unit is SRD being tested to ETS 301 489-3 please state Class of Equipment as defined in Section 6.1	3	
BATTERY/POWER SUPPLY		
MANUFACTURING DESCRIPTION	Li-Ion Battery	AC-Charger
MANUFACTURER	VARTA	Tenwei
TYPE	Li-Ion 2600mAh	TAV01-00501200
PART NUMBER	56626 701 099	
VOLTAGE	3.7V	5V
SERIAL NUMBER	NA	NA
ANCILLARIES (if applicable)		
MANUFACTURING DESCRIPTION	Headset	
MANUFACTURER	TopDen	
TYPE	Mono headset with 2.5mm plug	
PART NUMBER	TS628D-168-4	
SERIAL NUMBER	NA	

Signature

Held on File at TUV

Date

02 June 2010

D of B S Serial No

75909459/01

Note: This document has been prepared to enable manufacturers with no mechanism for producing their own Declaration of Build Status, to declare the build state of the equipment submitted for test.

No responsibility will be accepted by TÜV Product Service as to the accuracy of the information declared in this document by the manufacturer.



1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Inmarsat Global Ltd, IsatPhone Pro GMR2+ Satellite Phone as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.



Equipment Under Test



1.4.2 Test Configuration

Configuration 1: Mobile Handset + SHF

The EUT was configured in accordance with FCC CFR 47 Part 25 and Part 2 and RSS-170.

Configuration 2: Mobile Handset + AC Charger + SHF

The EUT was configured in accordance with FCC CFR 47 Part 25 and Part 2 and RSS-170.

Configuration 3: Mobile Handset + USB + SHF

The EUT was configured in accordance with FCC CFR 47 Part 25 and Part 2 and RSS-170.

Configuration 4: Mobile Handset + DC Charger

The EUT was configured in accordance with FCC CFR 47 Part 25 and Part 2 and RSS-170.

1.4.3 EUT Cable / Port Identification

Port	Max Cable Length specified	Usage	Type	Screened
AC Power	1.5m	AC Power Lead	2 core	No
USB Data	1.5m	Data Transfer	Multicore	No

1.4.4 Modes of Operation

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

Mode 1 – Carrier On



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, test laboratories or an open test area as appropriate.

The EUT was powered from a 3.7V internal battery or an AC power supply.

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation
IC2932B-1 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

The table below details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.

IMEI: 004401510018258

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer (HWID: 0321 Rx Modification Fitted)	Sasken	05 May 2010

IMEI: 004401510018217

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer (HWID: 0321 Rx Modification Fitted)	Sasken	05 May 2010



Product Service

SECTION 2

TEST DETAILS

FCC and Industry Canada Testing of the
Inmarsat Global Ltd IsatPhone Pro GMR2+ Satellite Phone



Product Service

2.1 SPURIOUS EMISSIONS (RADIATED)

2.1.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1053
FCC CFR 47 Part 25, Clause 25.202 (f)(3)
RSS-170, Clause Annex B: B3

2.1.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018183

2.1.3 Date of Test and Modification State

04 May, 27 May and 30 May 2010 - 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 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.

Through this process of profiling the EUT, it was determined that the worst case was Configuration 2 (Mobile Handset + AC Charger + SHF), therefore a full sweep of plots for Top, Middle and Bottom Channels has been presented. For Configurations 1 and 3 a plot showing 30MHz to 1GHz for the Top and Bottom Channels plus a full sweep of plots for the Middle Channel have also been presented in this document to support this judgement.

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

Configuration 1 - Mode 1
Configuration 2 - Mode 1
Configuration 3 - Mode 1
Configuration 4 - Mode 1



Product Service

2.1.6 Environmental Conditions

	04 May 2010	27 May 2010	30 May 2010
Ambient Temperature	20.0°C	21.0°C	19.2°C
Relative Humidity	32%	42%	45%
Atmospheric Pressure	1020mbar	1005mbar	1005mbar



Product Service

2.1.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 25 and RSS-170 for Spurious Emissions (Radiated).

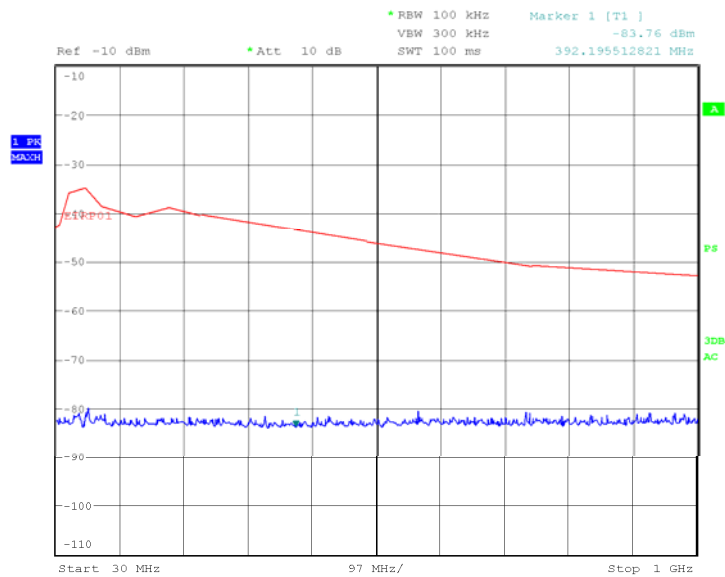
The test results are shown below.

Configuration 1 - Mode 1

Top Channel

30MHz to 1GHz

Vertical

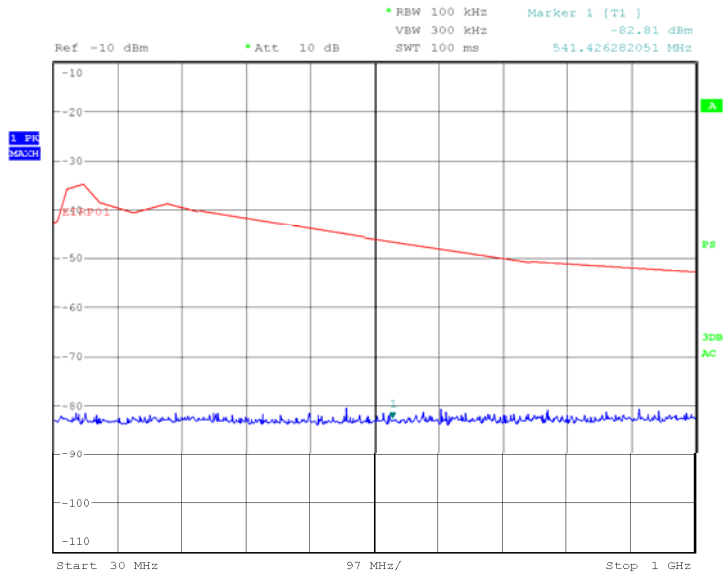


Date: 29.MAY.2010 22:30:32



Product Service

Horizontal



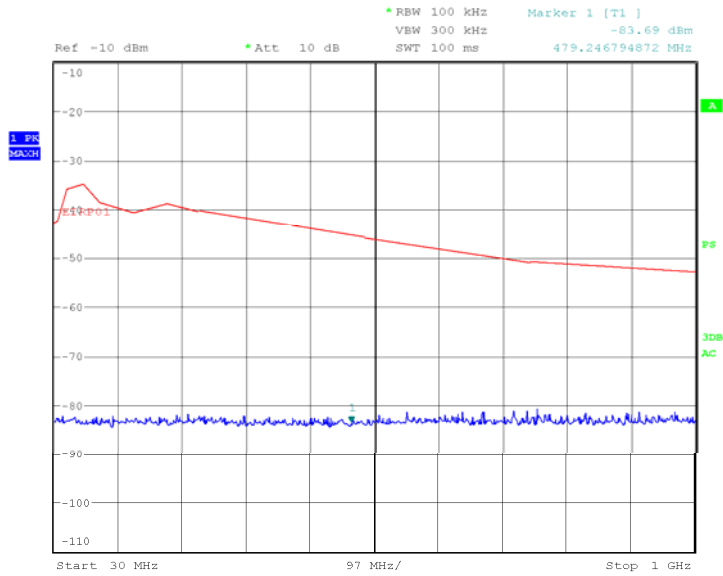
Date: 29.MAY.2010 22:32:44



Middle Channel

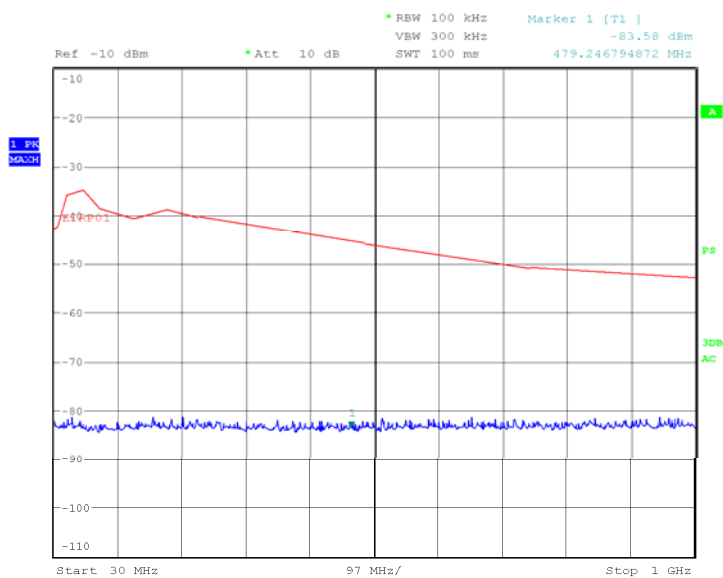
30 MHz to 1 GHz

Vertical



Date: 29.MAY.2010 21:56:48

Horizontal

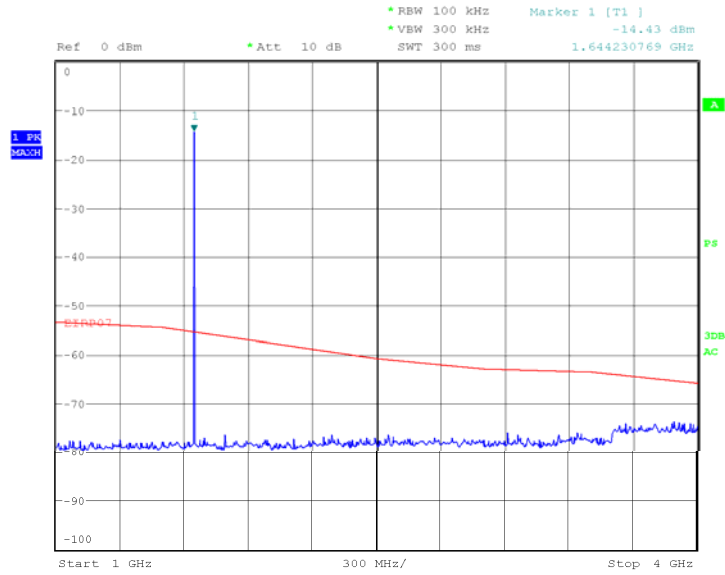


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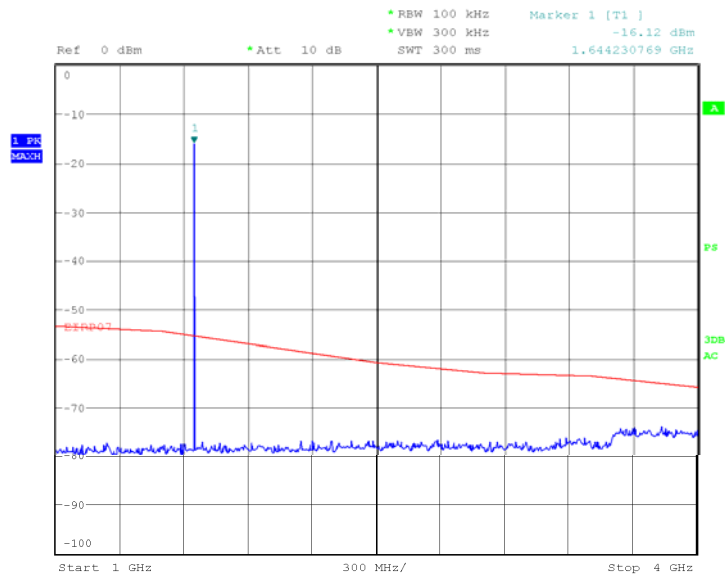
1 GHz to 4 GHz

Vertical



Date: 30.MAY.2010 02:39:07

Horizontal

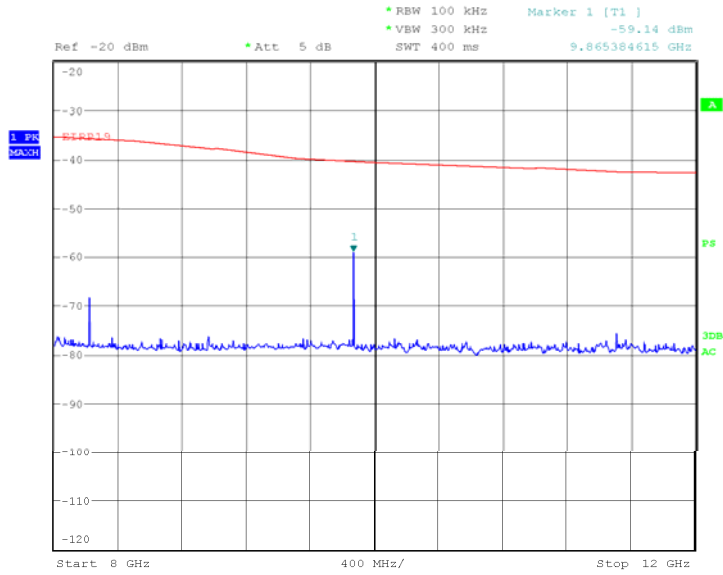


Date: 30.MAY.2010 02:37:07



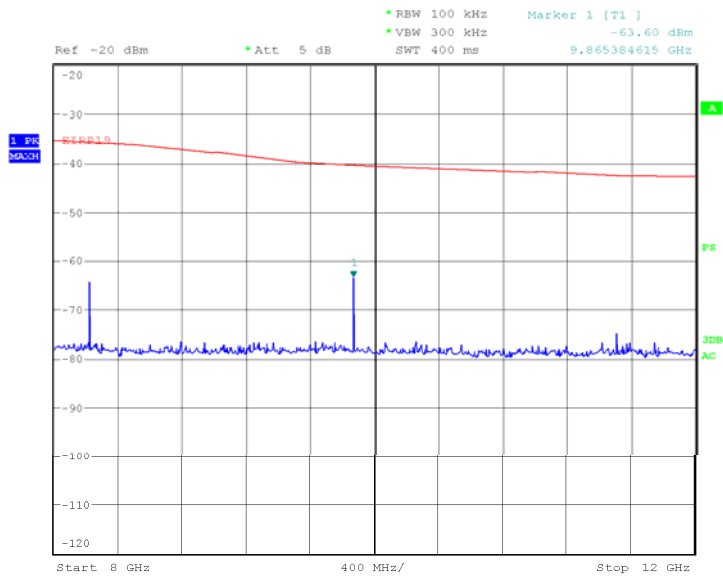
8 GHz to 12 GHz

Vertical



Date: 30.MAY.2010 03:45:26

Horizontal

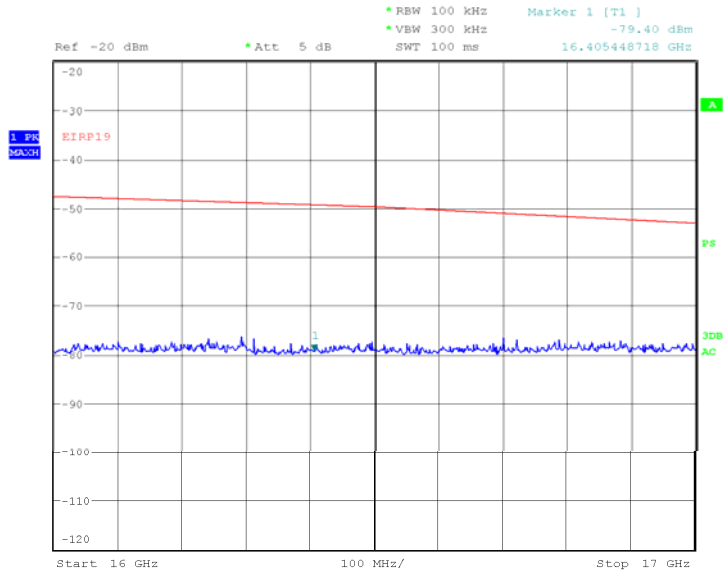


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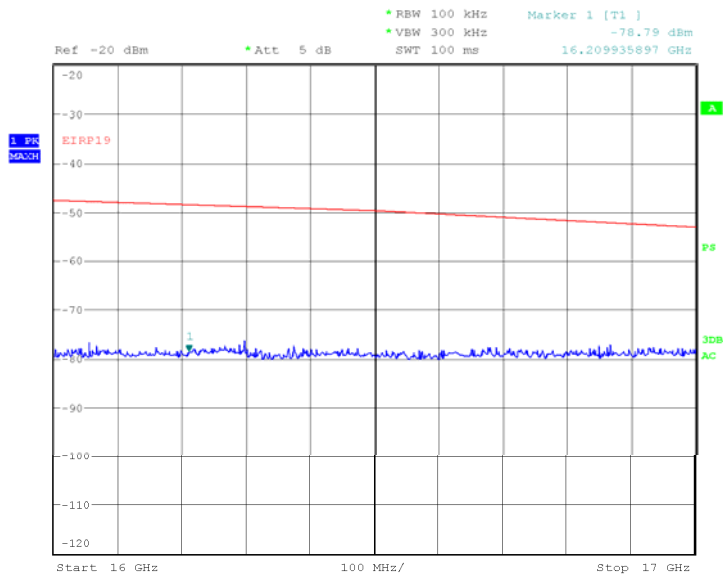
16 GHz to 17 GHz

Vertical



Date: 30.MAY.2010 03:41:14

Horizontal



Date: 30.MAY.2010 03:38:37



Final Result

Frequency (MHz)	Result Peak (dBm)	Limit (dBm)	Margin (dB)	Angle (deg)	Height (m)	Polarity
4930	-46.9	-13.0	-33.9	341	100	Horizontal
4930	-44.7	-13.0	-31.7	216	179	Vertical
6574	-42.7	-13.0	-29.7	206	100	Horizontal
6574	-39.9	-13.0	-26.9	141	100	Vertical
9862	-35.4	-13.0	-22.4	171	100	Vertical
9862	-37.2	-13.0	-24.2	202	136	Horizontal
14793	-33.8	-13.0	-20.8	182	100	Vertical

30MHz to 17GHz

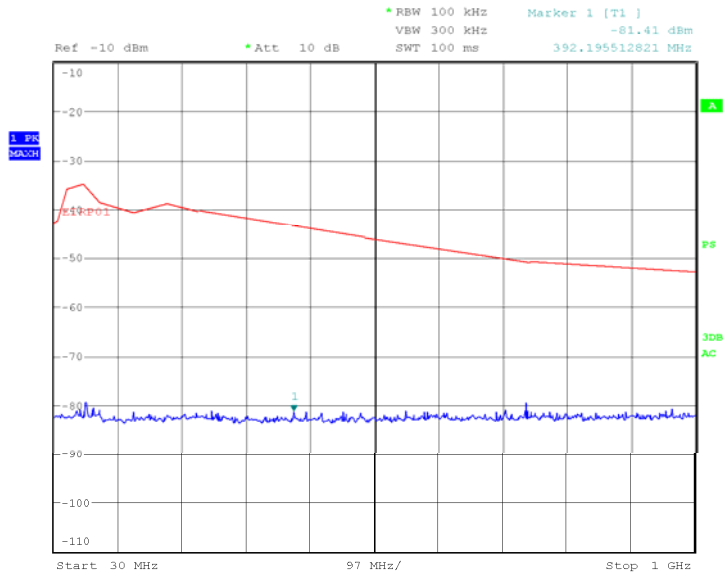
No emissions were detected within 22dB of the Peak limit.



Bottom Channel

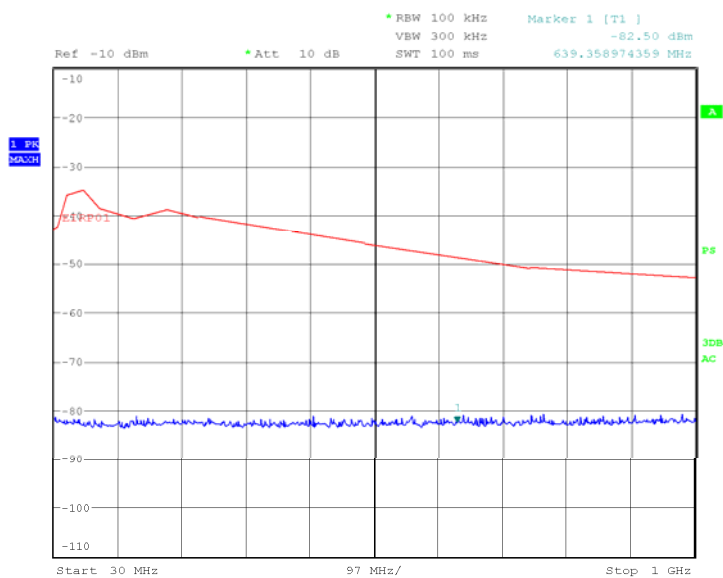
30 MHz to 1 GHz

Vertical



Date: 29.MAY.2010 22:12:52

Horizontal



Date: 29.MAY.2010 22:07:06



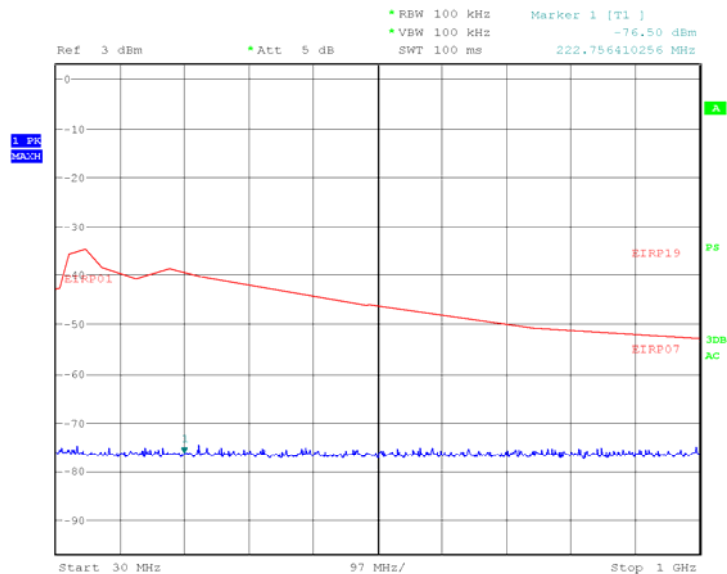
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Configuration 2 - Mode 1

Top Channel

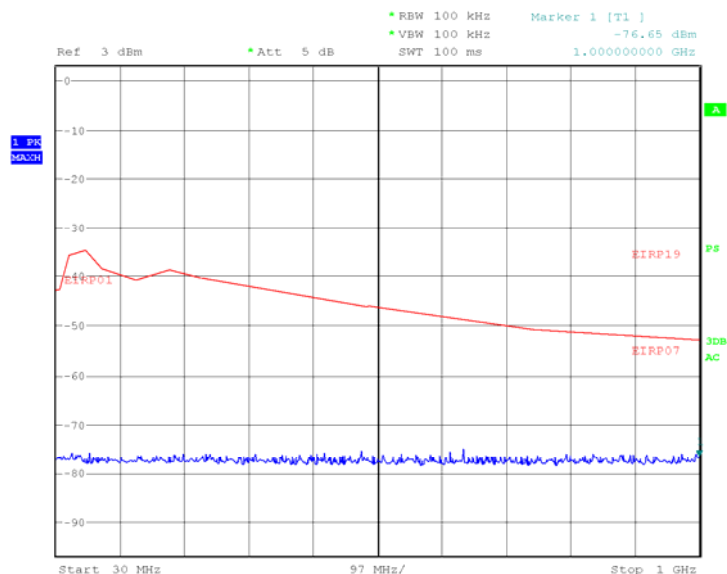
30MHz to 1GHz

Vertical



Date: 5.MAY.2010 00:06:03

Horizontal

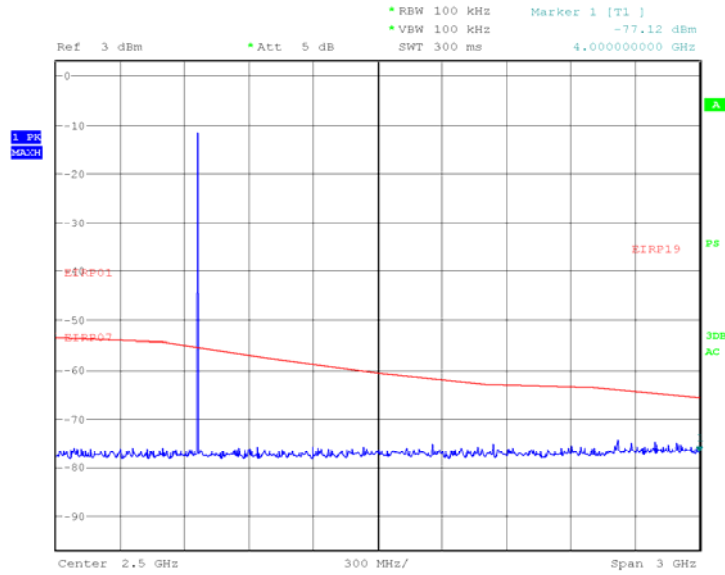


Date: 4.MAY.2010 23:49:19



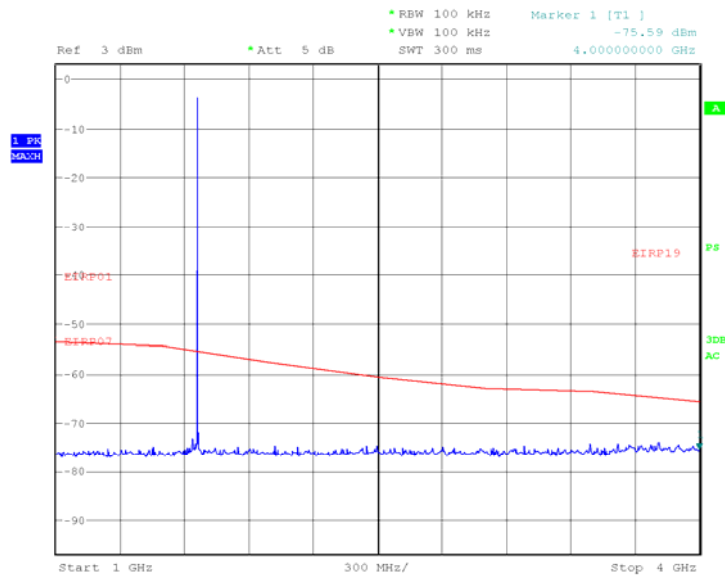
1 GHz to 4 GHz

Vertical



Date: 4.MAY.2010 23:35:40

Horizontal

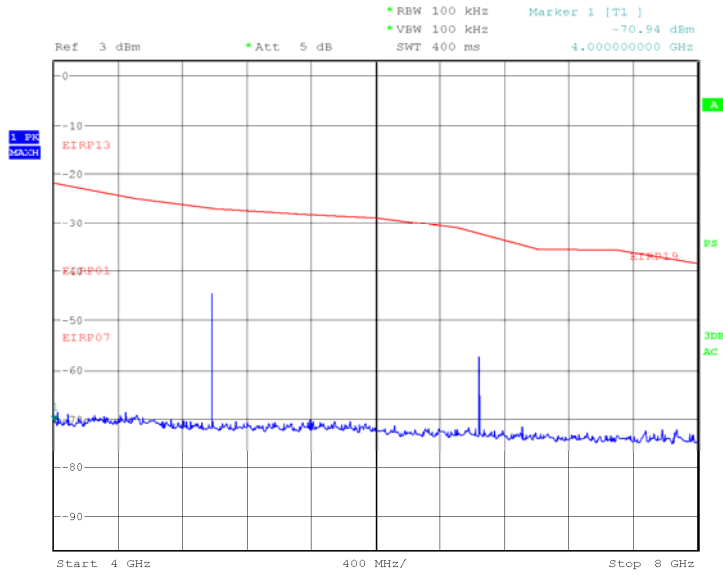


Date: 4.MAY.2010 23:47:46



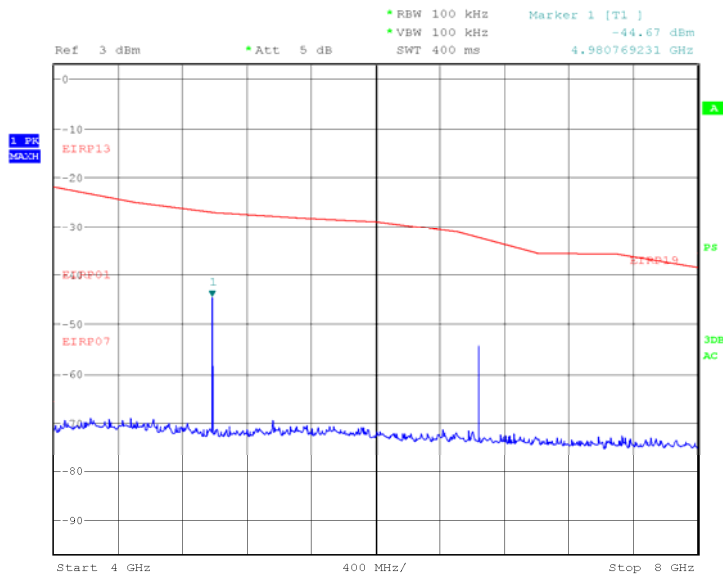
4 GHz to 8 GHz

Vertical



Date: 4.MAY.2010 23:18:23

Horizontal

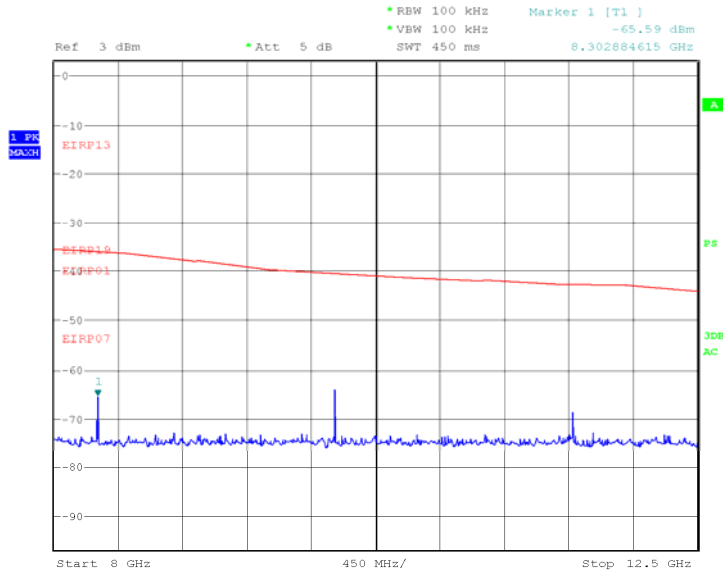


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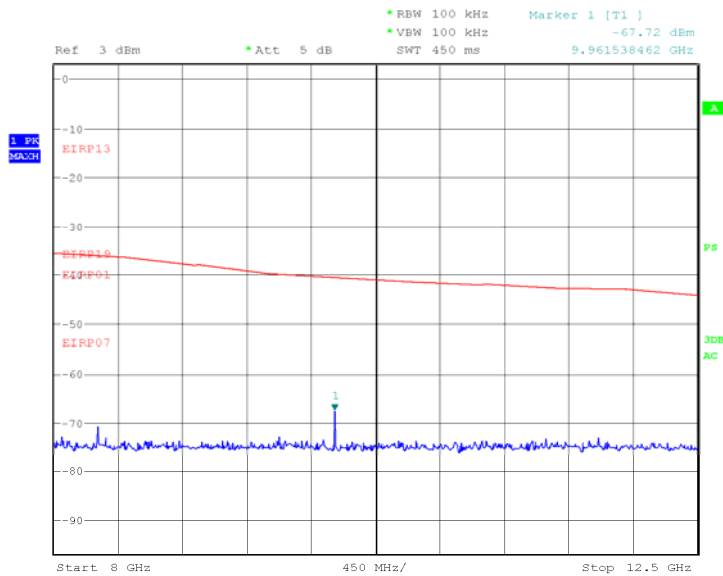
8 GHz to 12.5 GHz

Vertical



Date: 4.MAY.2010 23:23:36

Horizontal

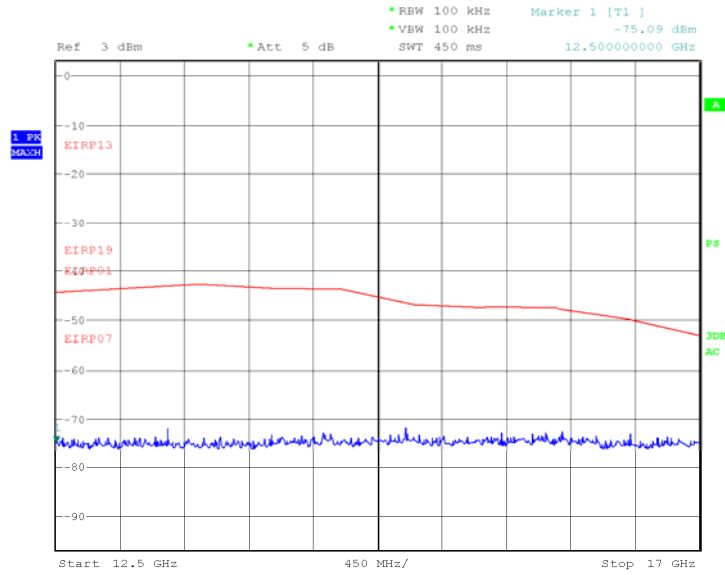


Date: 4.MAY.2010 23:28:29



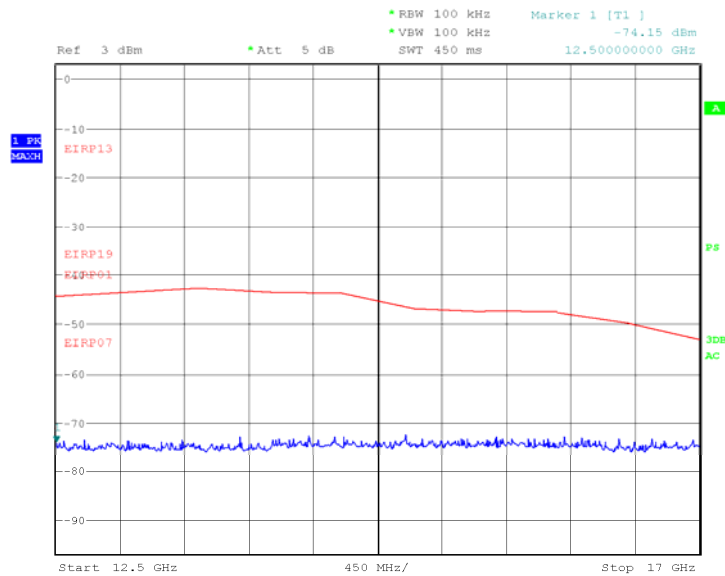
12.5 GHz to 17 GHz

Vertical



Date: 4.MAY.2010 23:24:40

Horizontal



Date: 4.MAY.2010 23:27:01



Product Service

Final Result

Frequency (MHz)	Result Peak (dBm)	Limit (dBm)	Margin (dB)	Angle (deg)	Height (m)	Polarity
14640	-34.9	-13.0	-21.9	26	163	Vertical

30MHz to 17GHz

No emissions were detected within 21dB of the Peak limit.

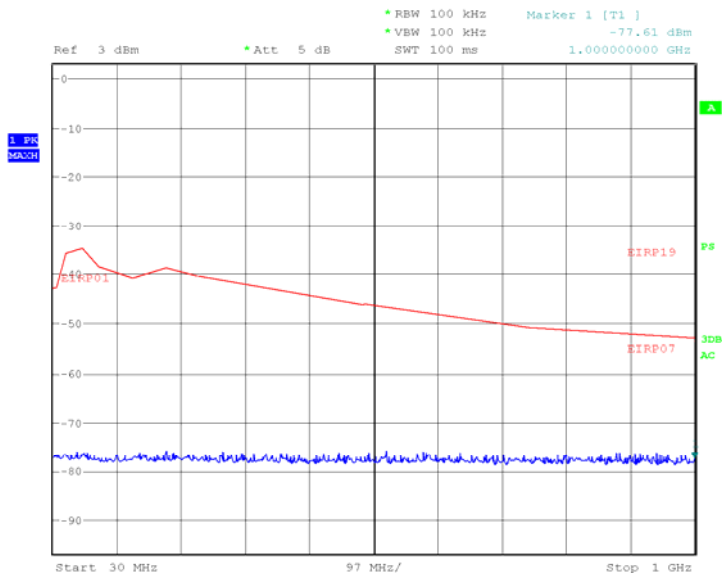


Product Service

Middle Channel

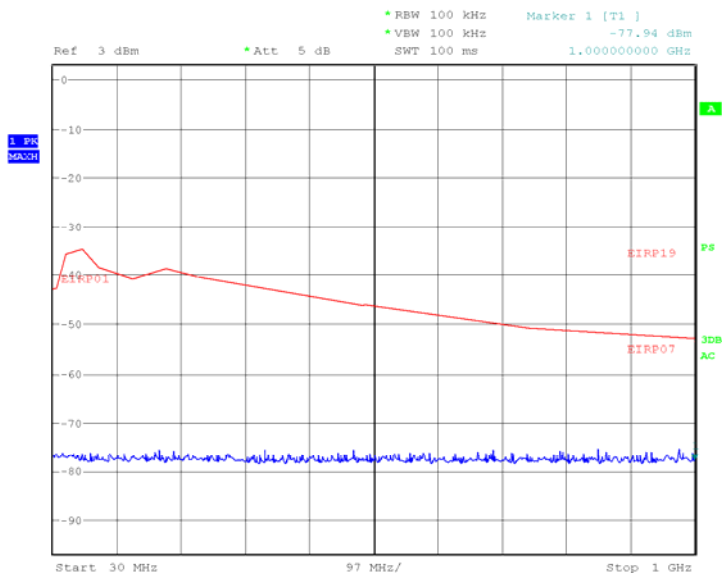
30MHz to 1GHz

Vertical



Date: 4.MAY.2010 22:25:07

Horizontal

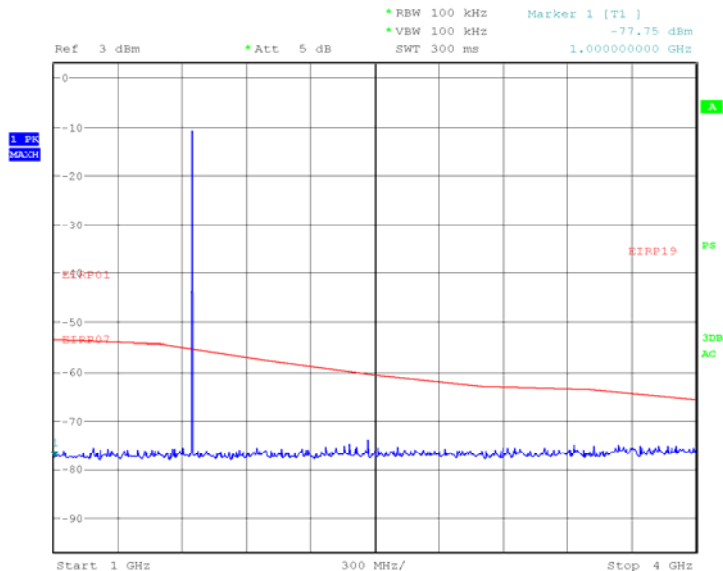


Date: 4.MAY.2010 22:26:19



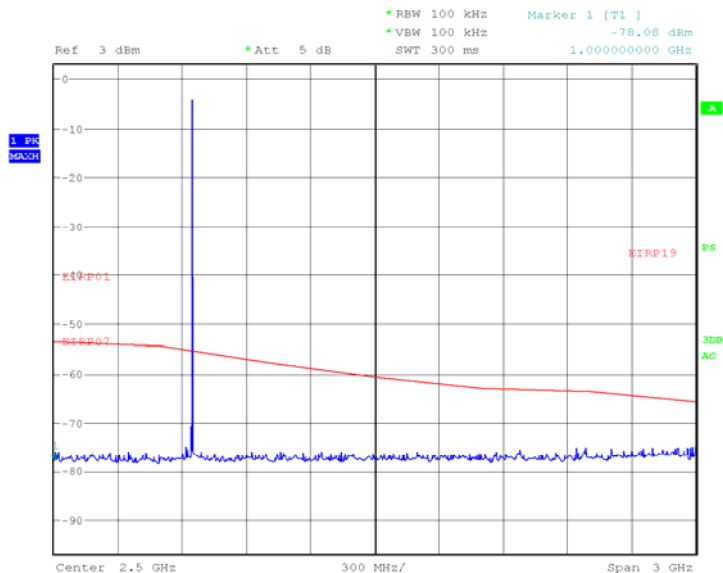
1 GHz to 4 GHz

Vertical



Date: 4.MAY.2010 22:29:53

Horizontal

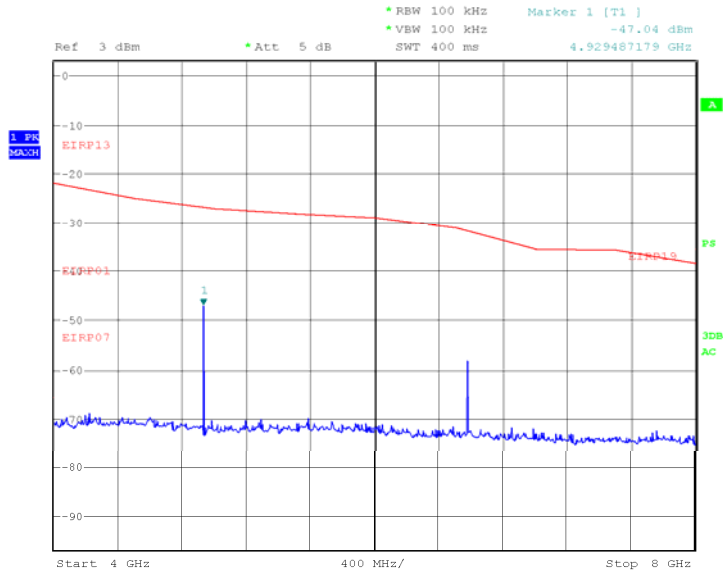


Date: 4.MAY.2010 22:31:29



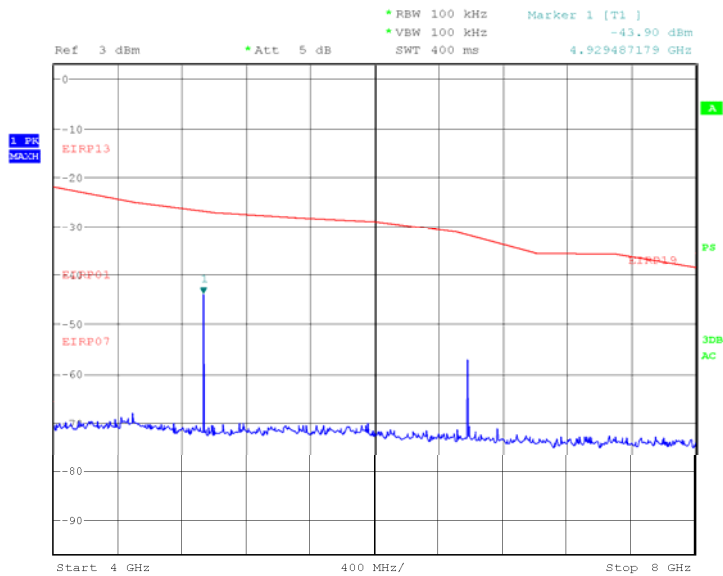
4 GHz to 8 GHz

Vertical



Date: 4.MAY.2010 23:02:01

Horizontal



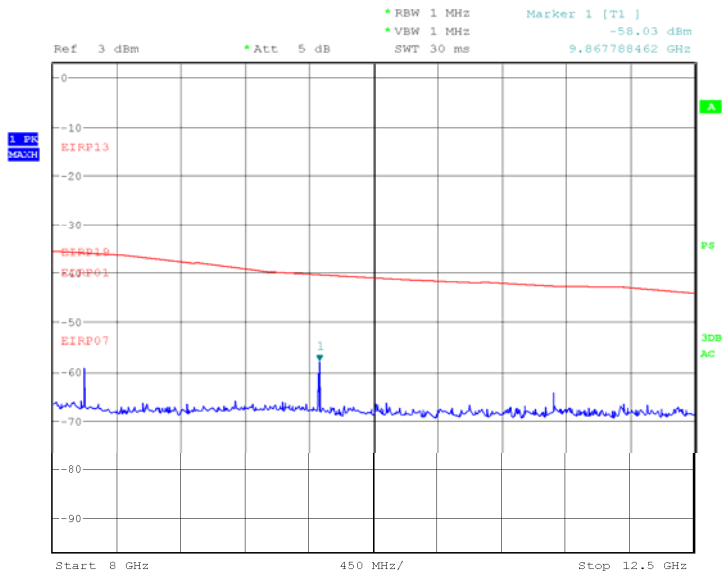
Date: 4.MAY.2010 23:04:01



Product Service

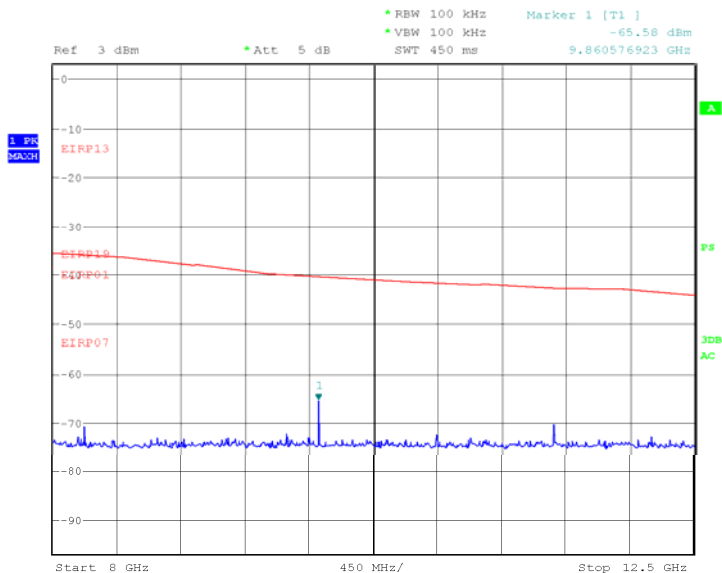
8 GHz to 12.5 GHz

Vertical



Date: 4.MAY.2010 22:49:32

Horizontal

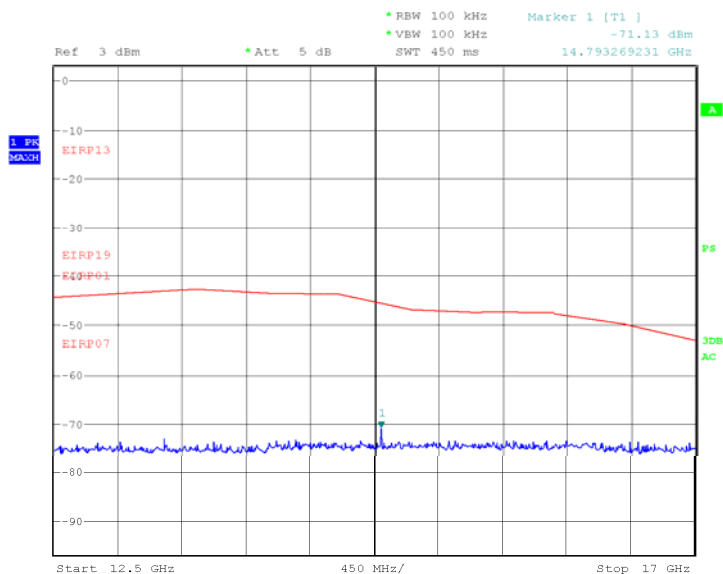


Date: 4.MAY.2010 22:54:01



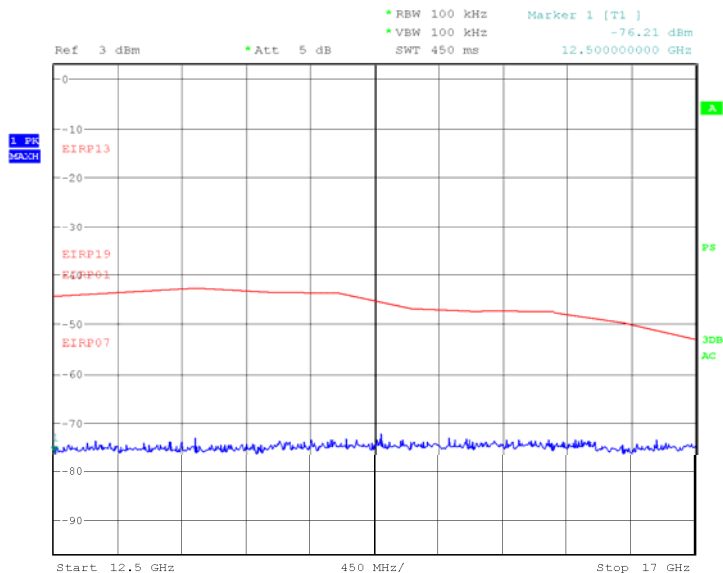
12.5 GHz to 17 GHz

Vertical



Date: 4.MAY.2010 22:44:55

Horizontal



Date: 4.MAY.2010 22:58:34



Product Service

Final Result

Frequency (MHz)	Result Peak (dBm)	Limit (dBm)	Margin (dB)	Angle (deg)	Height (m)	Polarity
14795	-34.8	-13.0	-21.8	22	164	Vertical

30MHz to 17GHz

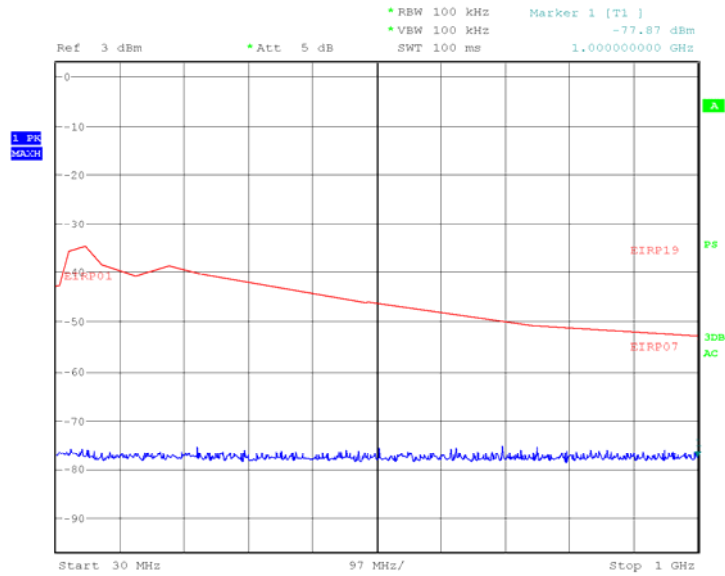
No emissions were detected within 21dB of the Peak limit.



Bottom Channel

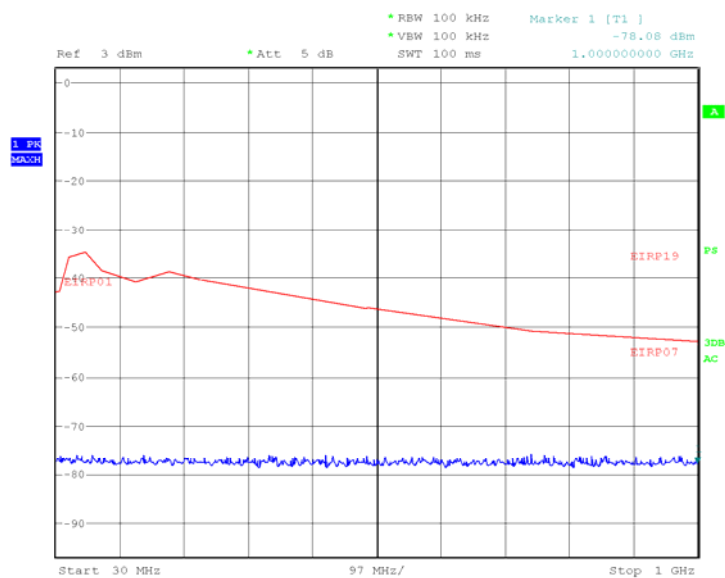
30MHz to 1GHz

Vertical



Date: 4.MAY.2010 22:19:20

Horizontal

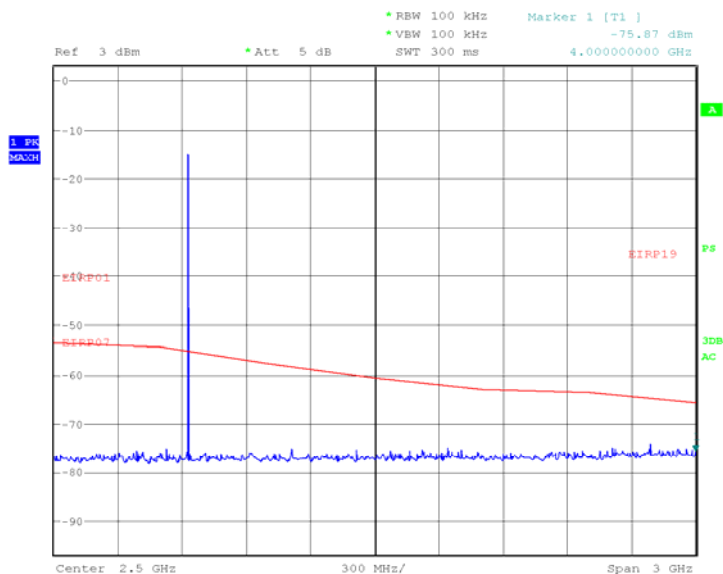


Date: 4.MAY.2010 22:20:27



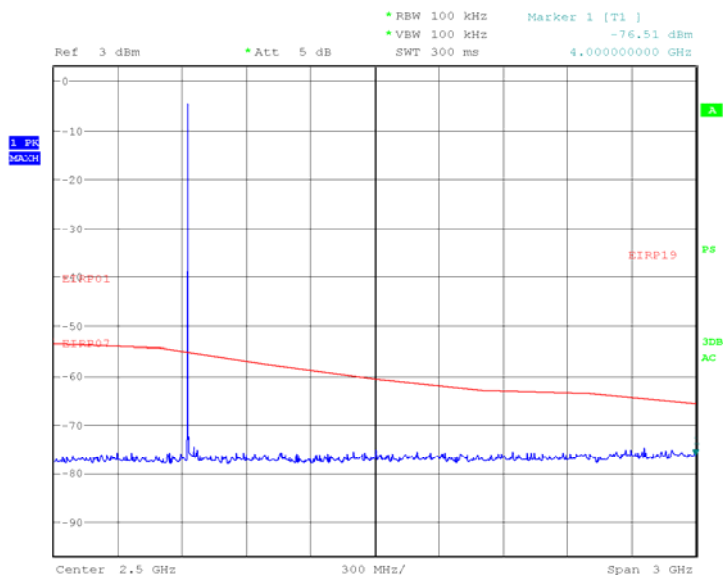
1 GHz to 4 GHz

Vertical



Date: 4.MAY.2010 21:49:34

Horizontal

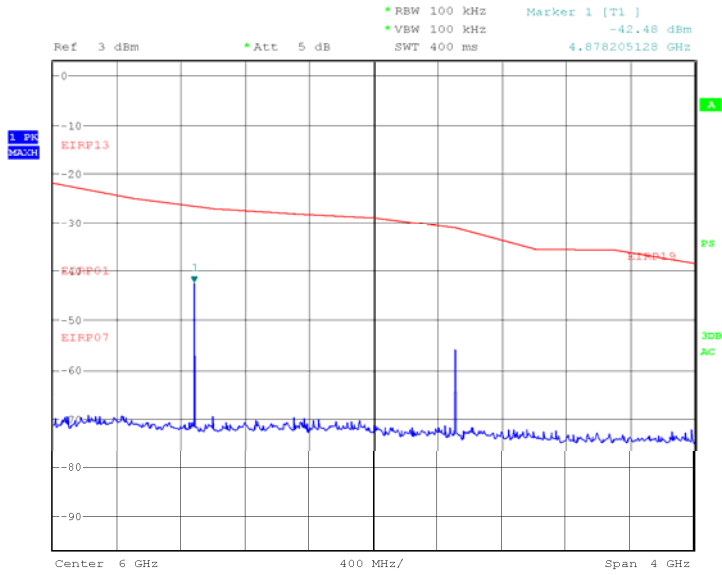


Date: 4.MAY.2010 21:51:42



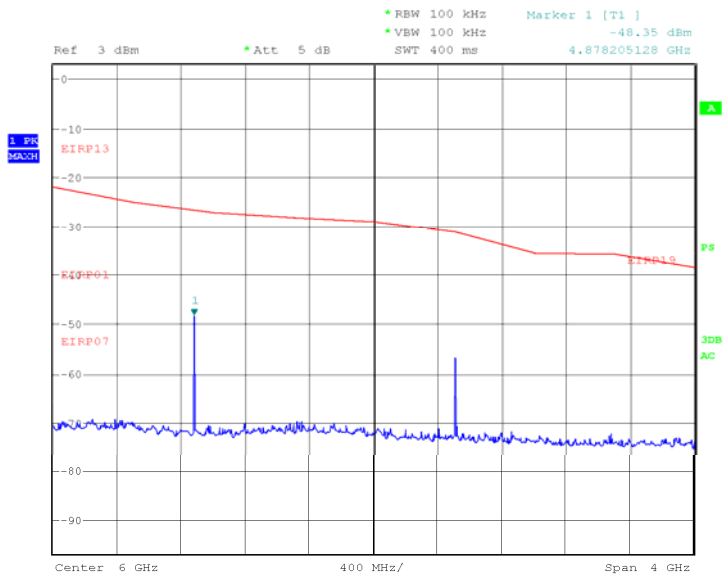
4 GHz to 8 GHz

Vertical



Date: 4.MAY.2010 21:43:45

Horizontal

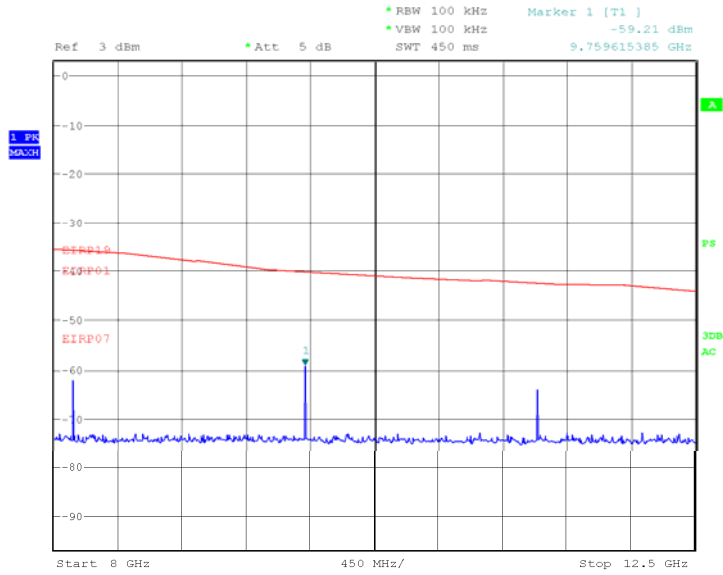


Date: 4.MAY.2010 21:45:43



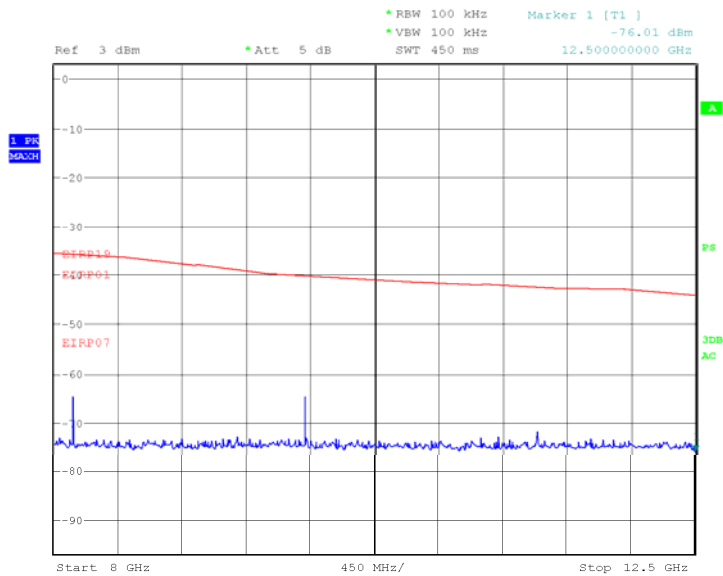
8 GHz to 12.5 GHz

Vertical



Date: 4.MAY.2010 21:58:44

Horizontal



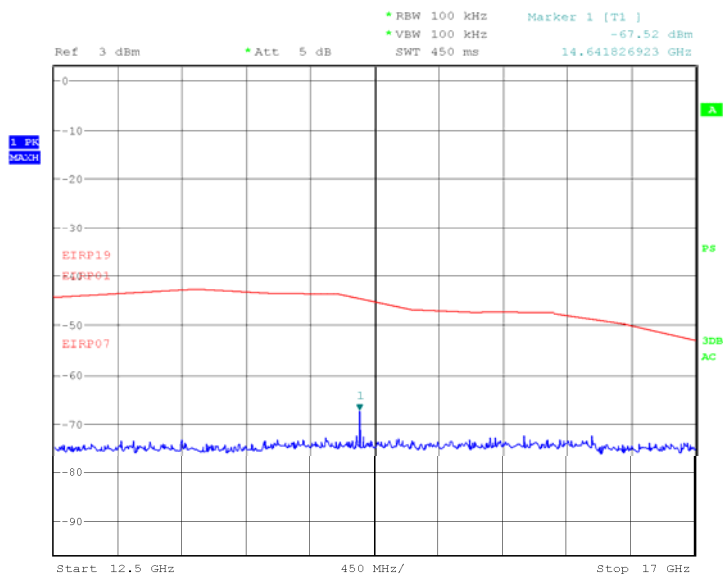
Date: 4.MAY.2010 22:02:06



Product Service

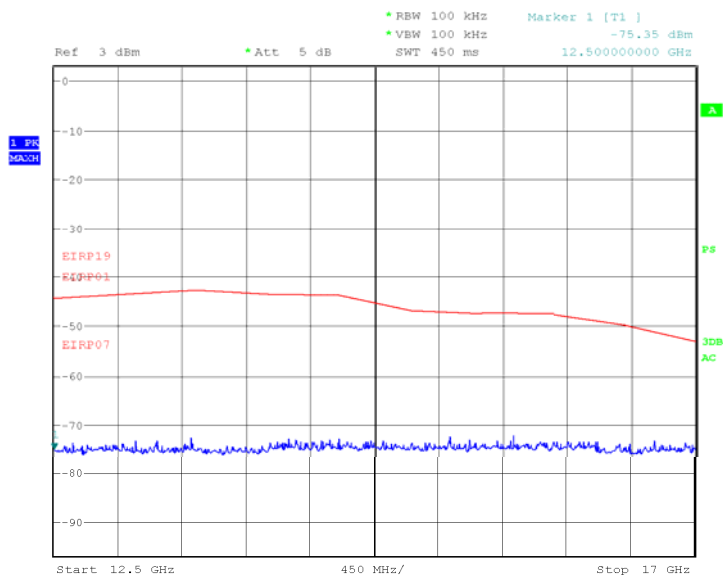
12.5 GHz to 17 GHz

Vertical



Date: 4.MAY.2010 22:00:13

Horizontal



Date: 4.MAY.2010 22:06:27



Product Service

Final Result

30MHz to 17GHz

No emissions were detected within 22dB of the Peak limit.



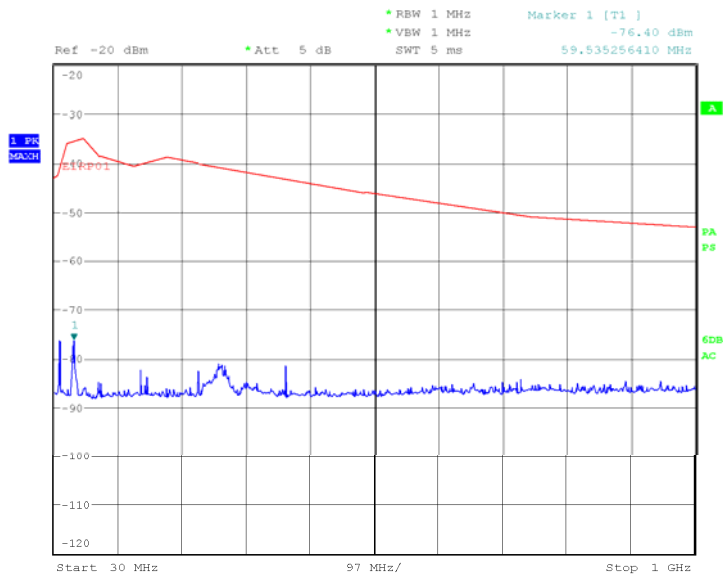
Product Service

Configuration 3 - Mode 1

Top Channel

30MHz to 1GHz

Combined Vertical and Horizontal

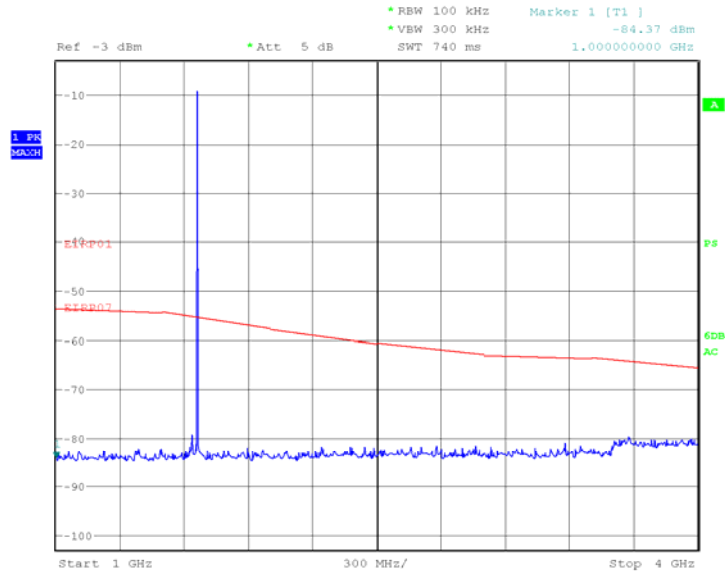


Date: 4.MAY.2010 16:40:17



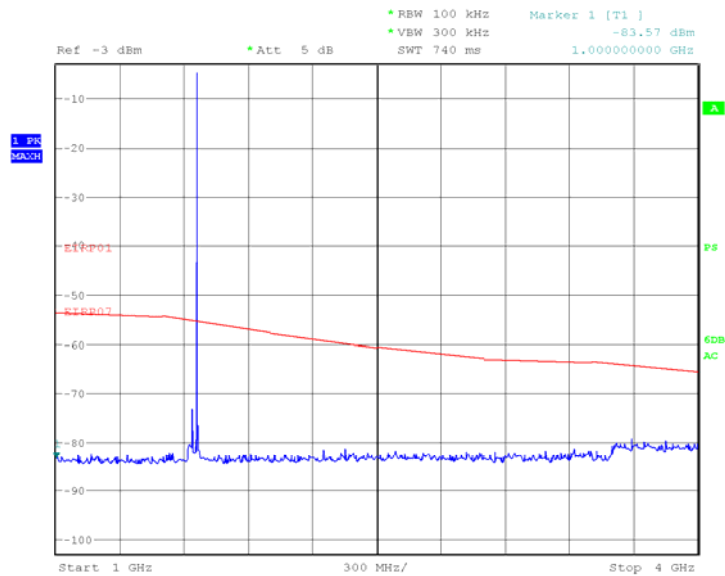
1 GHz to 4 GHz

Vertical



Date: 4.MAY.2010 16:49:21

Horizontal



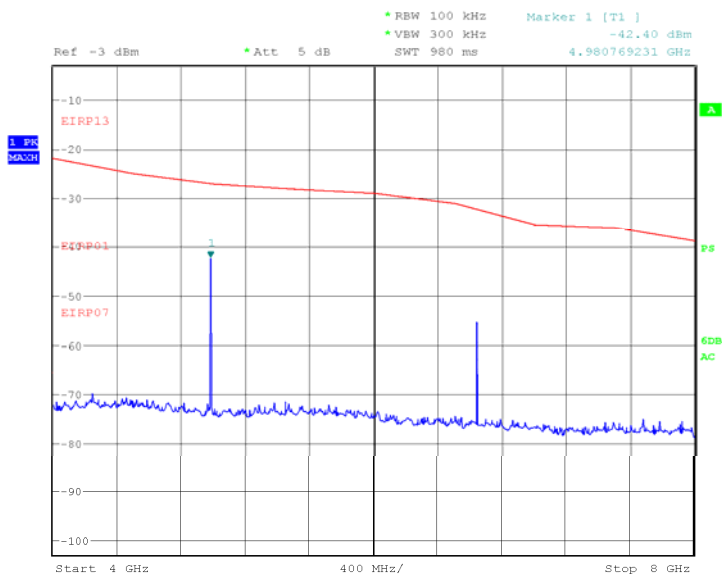
Date: 4.MAY.2010 16:51:07



Product Service

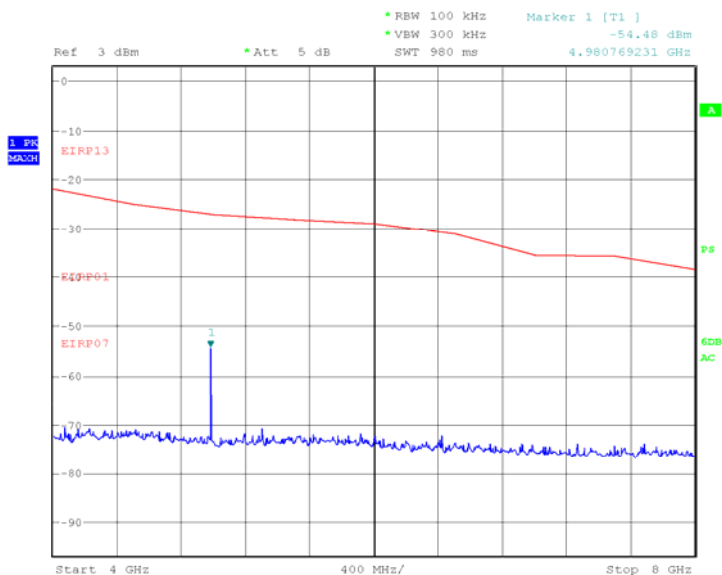
4 GHz to 8 GHz

Vertical



Date: 4.MAY.2010 17:03:25

Horizontal

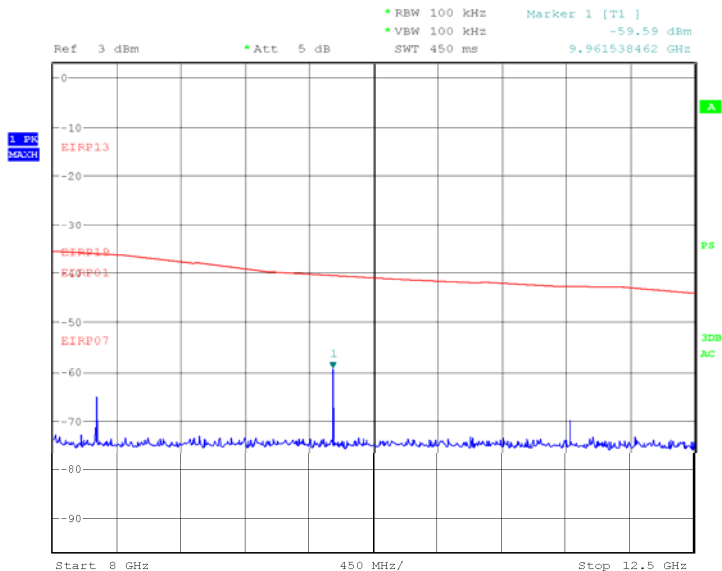


Date: 4.MAY.2010 17:23:35



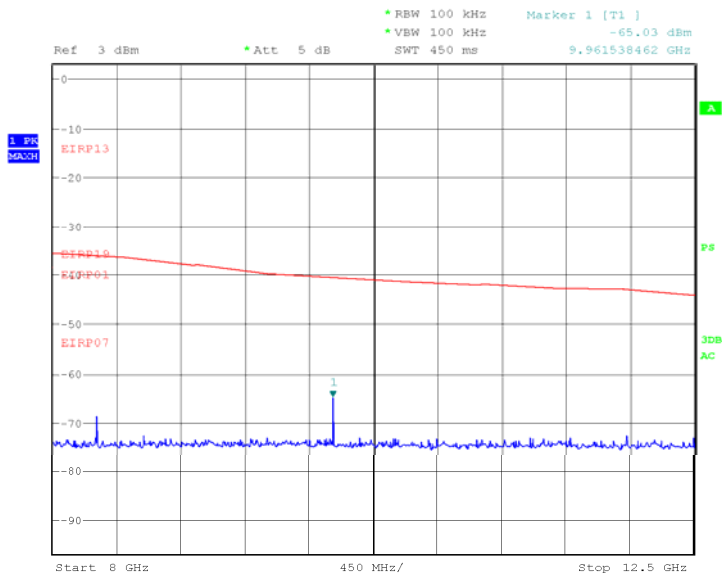
8 GHz to 12.5 GHz

Vertical



Date: 4.MAY.2010 17:46:16

Horizontal

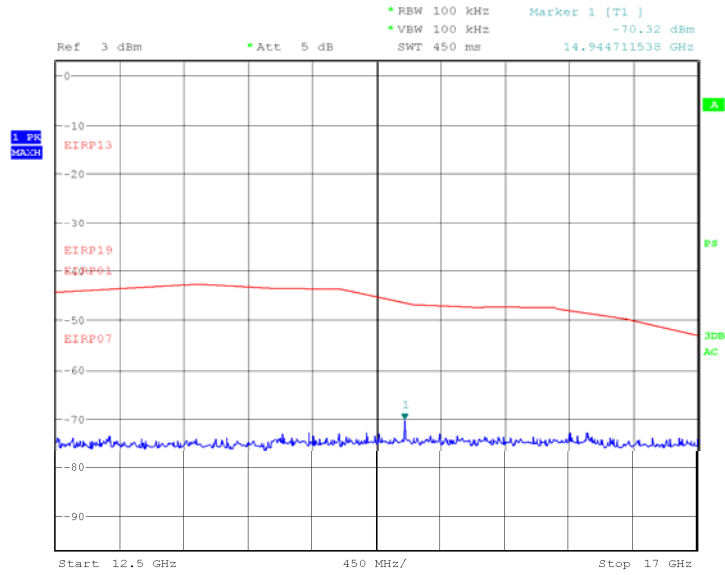


Date: 4.MAY.2010 17:55:28



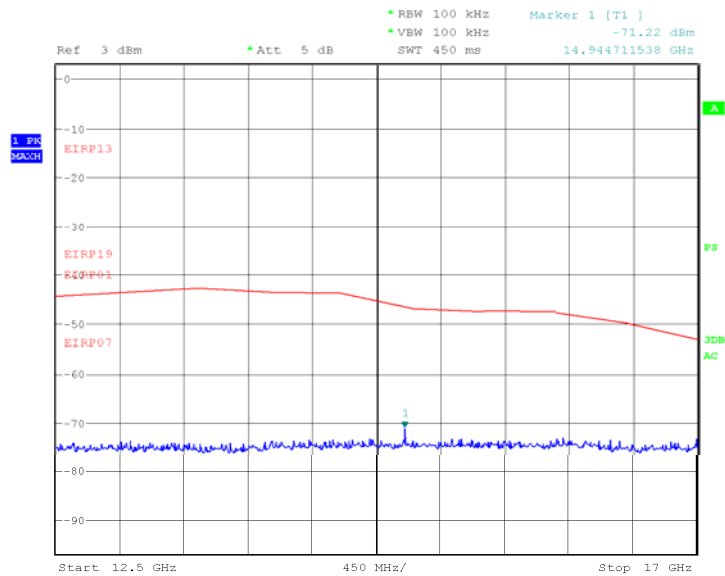
12.5 GHz to 17 GHz

Vertical



Date: 4.MAY.2010 17:51:25

Horizontal



Date: 4.MAY.2010 17:52:52



Final Result

Frequency (MHz)	Result Peak (dBm)	Limit (dBm)	Margin (dB)	Angle (deg)	Height (m)	Polarity
4981	-36.0	-13.0	-23.0	255	102	Vertical
6641	-38.3	-13.0	-25.3	060	102	Vertical
4981	-28.4	-13.0	-15.4	307	103	Horizontal
6641	-36.3	-13.0	-23.3	270	221	Horizontal
9963	-35.3	-13.0	-22.3	230	162	Vertical

30MHz to 17GHz

No emissions were detected within 22dB of the Peak limit.

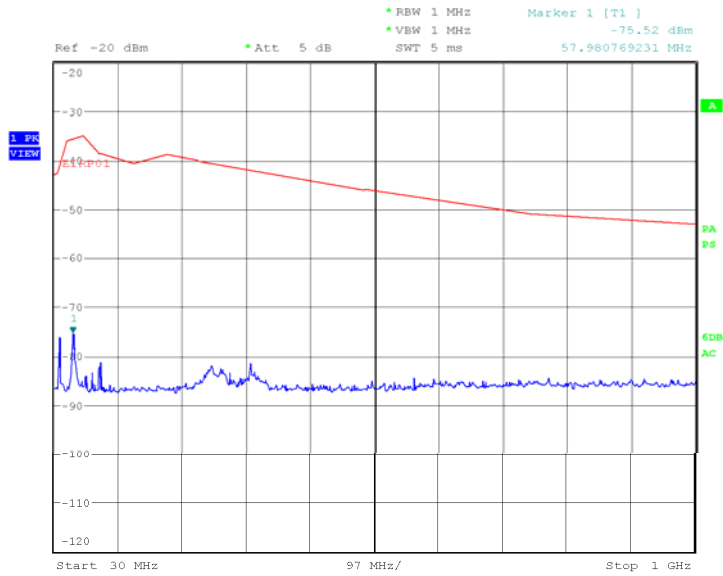


Product Service

Middle Channel

30MHz to 1GHz

Combined Vertical and Horizontal



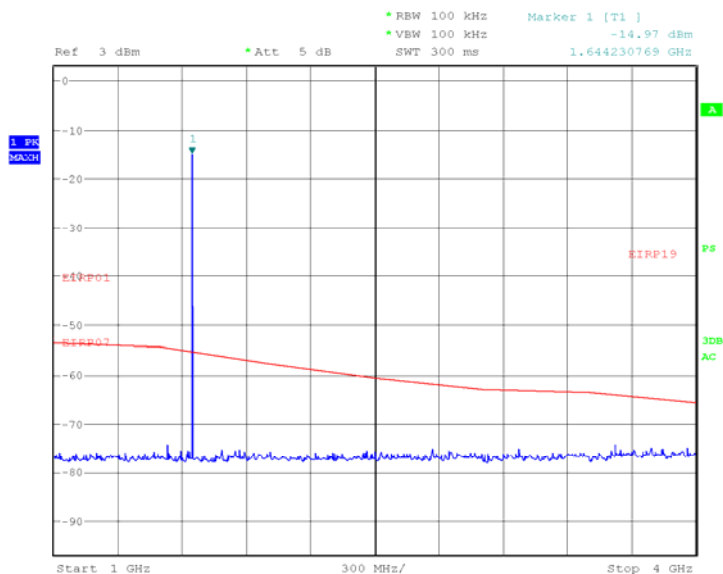
Date: 4.MAY.2010 16:09:22



Product Service

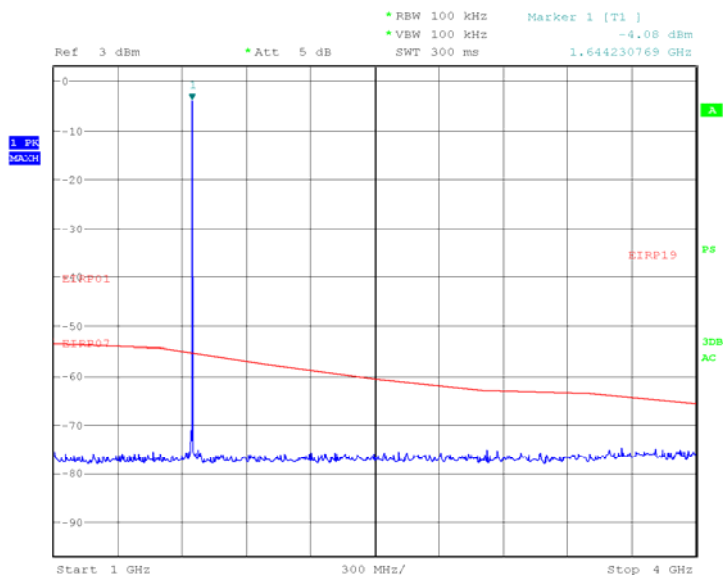
1 GHz to 4 GHz

Vertical



Date: 4.MAY.2010 19:18:58

Horizontal

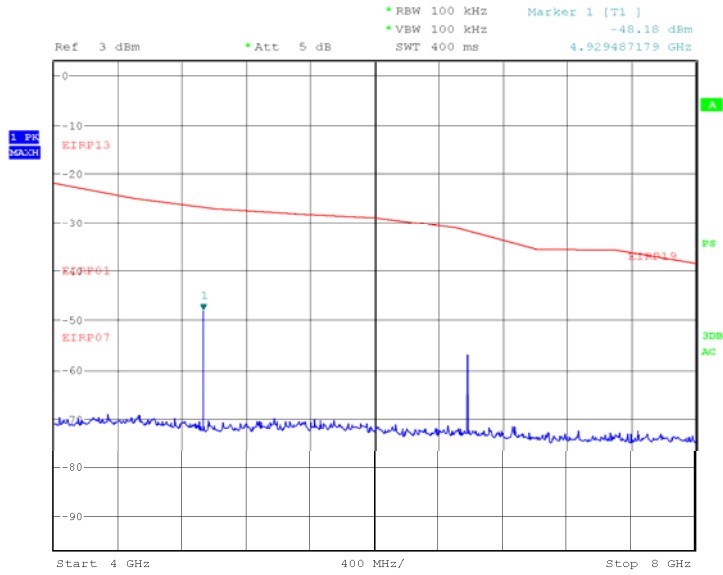


Date: 4.MAY.2010 19:20:58



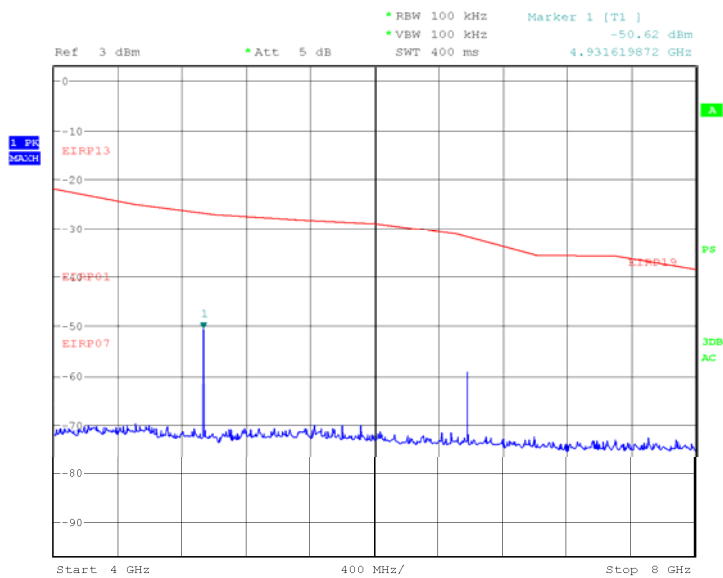
4 GHz to 8 GHz

Vertical



Date: 4.MAY.2010 18:28:54

Horizontal



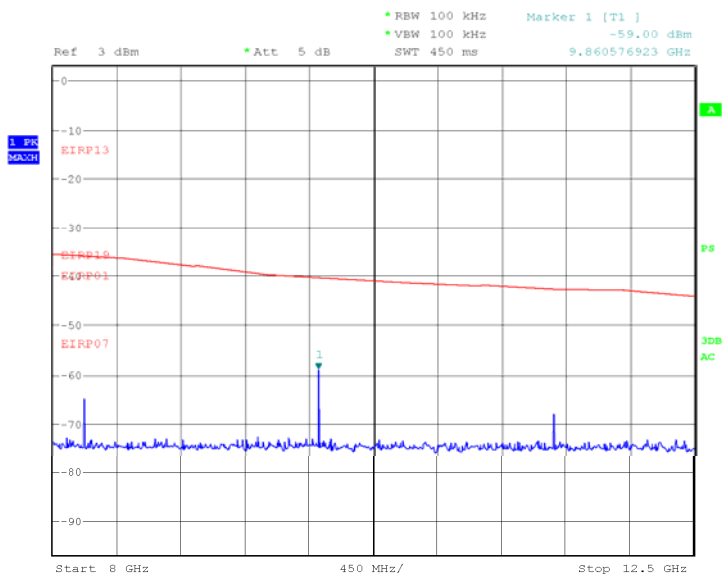
Date: 4.MAY.2010 18:50:15



Product Service

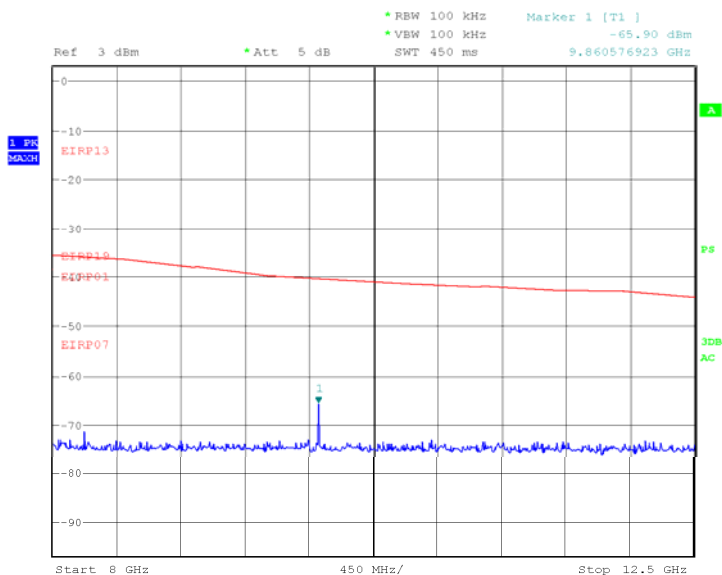
8 GHz to 12.5 GHz

Vertical



Date: 4.MAY.2010 18:00:40

Horizontal

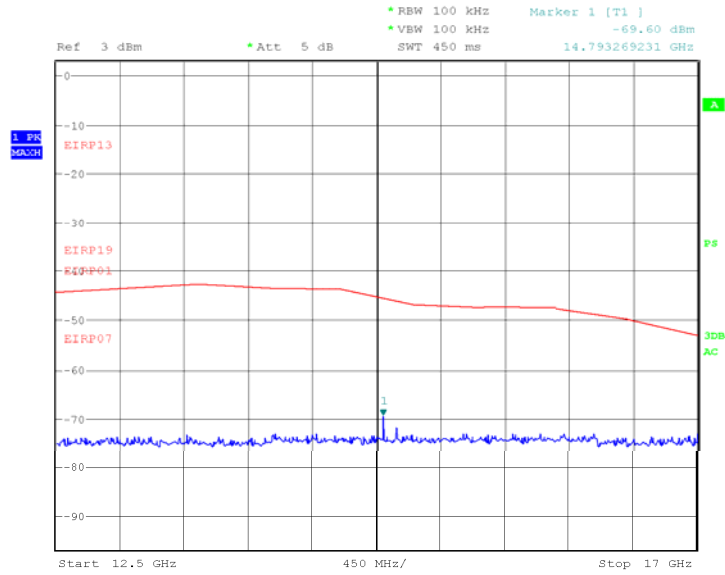


Date: 4.MAY.2010 18:10:59



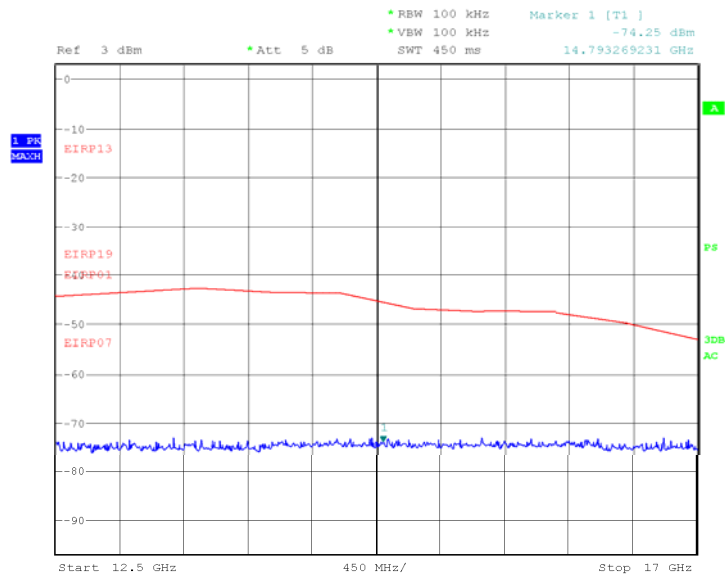
12.5 GHz to 17 GHz

Vertical



Date: 4.MAY.2010 18:07:55

Horizontal



Date: 4.MAY.2010 18:09:42



Final Result

Frequency (MHz)	Result Peak (dBm)	Limit (dBm)	Margin (dB)	Angle (deg)	Height (m)	Polarity
4932	-36.3	-13.0	-23.0	254	100	Vertical
6576	-42.8	-13.0	-29.8	036	100	Vertical
4929	-37.3	-13.0	-24.3	305	100	Horizontal
6576	-39.2	-13.0	-26.2	309	147	Horizontal
9861	-37.8	-13.0	-24.8	178	100	Vertical

30MHz to 17GHz

No emissions were detected within 23dB of the Peak limit.

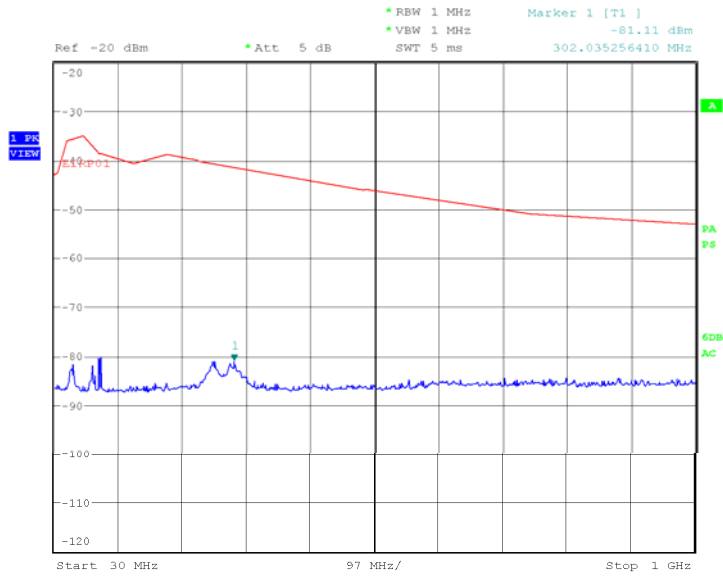


Product Service

Bottom Channel

30MHz to 1GHz

Combined Vertical and Horizontal



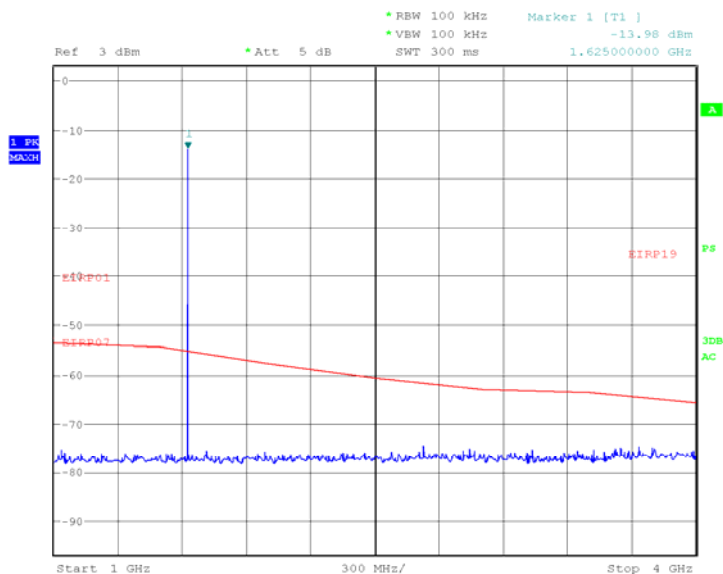
Date: 4.MAY.2010 15:32:31



Product Service

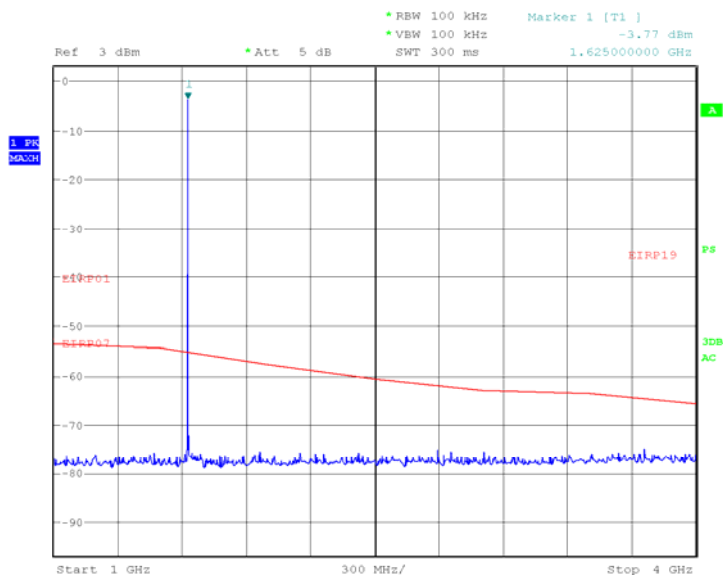
1 GHz to 4 GHz

Vertical



Date: 4.MAY.2010 19:31:18

Horizontal

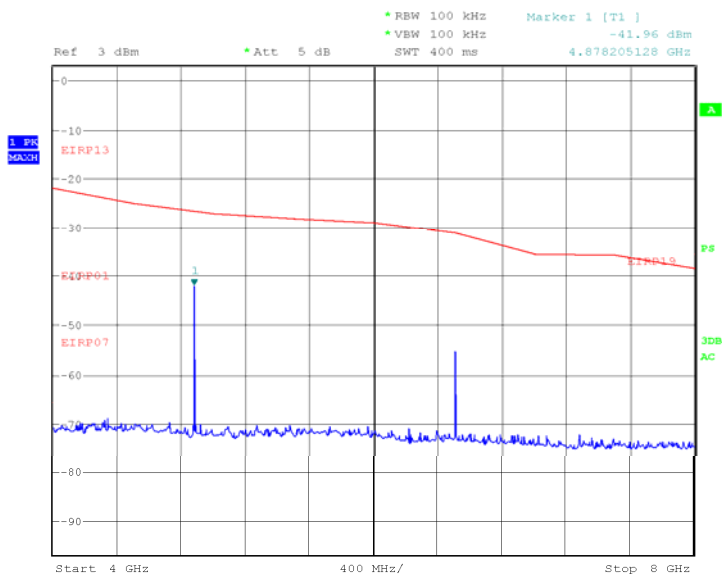


Date: 4.MAY.2010 19:28:21



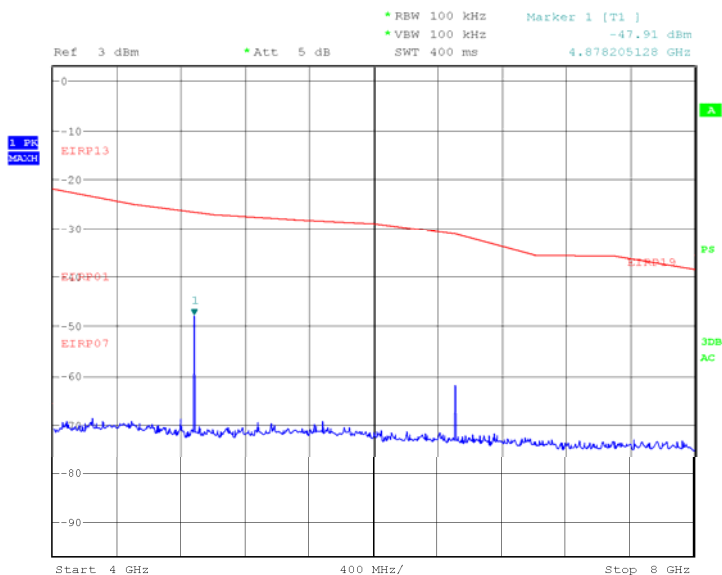
4 GHz to 8 GHz

Vertical



Date: 4.MAY.2010 19:35:03

Horizontal

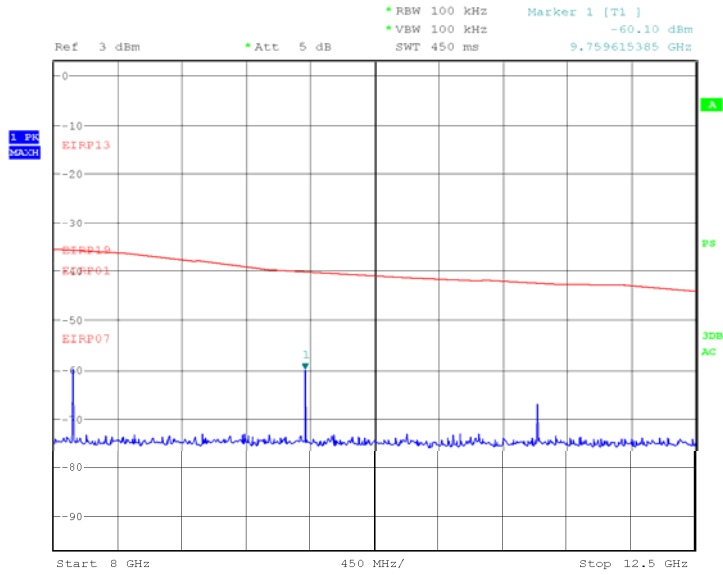


Date: 4.MAY.2010 19:44:19



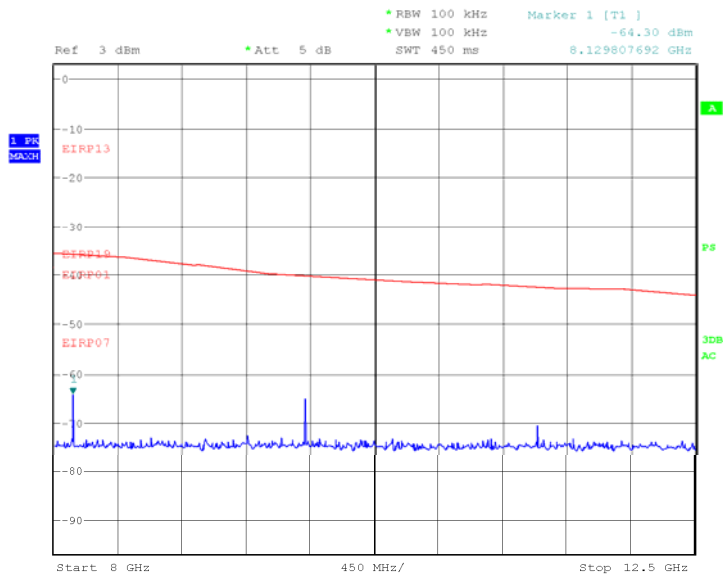
8 GHz to 12.5 GHz

Vertical



Date: 4.MAY.2010 19:58:31

Horizontal

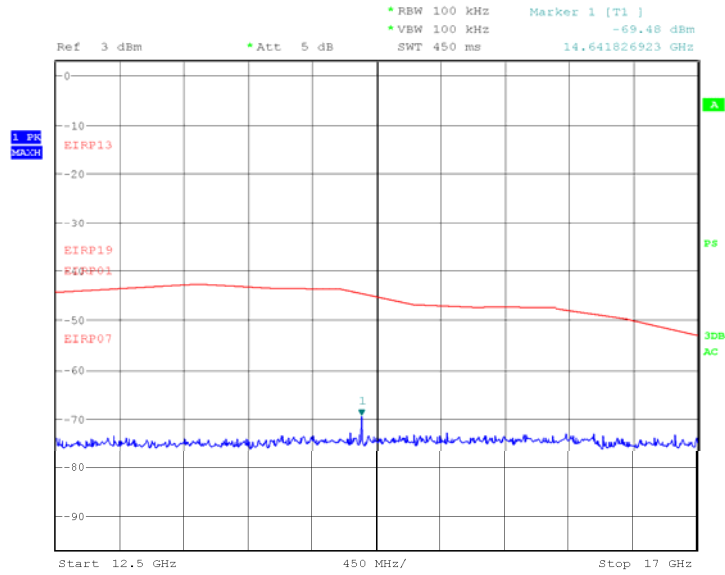


Date: 4.MAY.2010 20:11:22



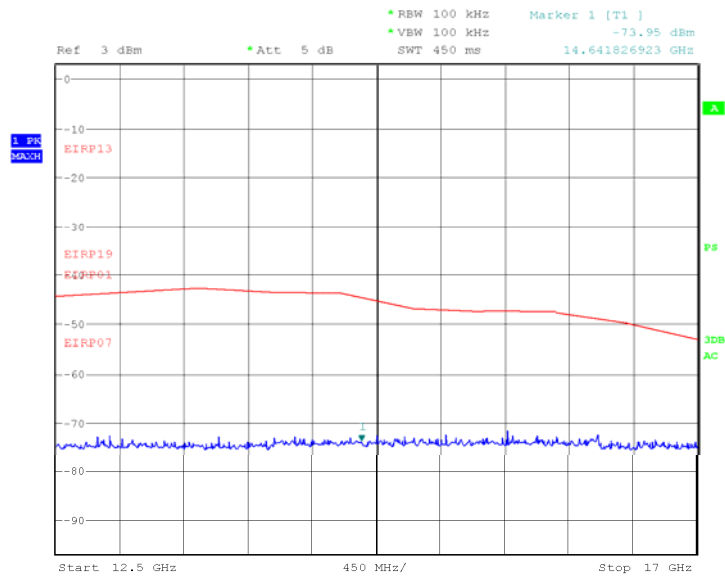
12.5 GHz to 17 GHz

Vertical



Date: 4.MAY.2010 20:06:31

Horizontal



Date: 4.MAY.2010 20:09:39



Final Result

Frequency (MHz)	Result Peak (dBm)	Limit (dBm)	Margin (dB)	Angle (deg)	Height (m)	Polarity
4878	-35.3	-13.0	-22.3	242	100	Vertical
6507	-37.4	-13.0	-24.4	25	110	Vertical
4878	-35.0	-13.0	-22.0	300	100	Horizontal
6507	-37.3	-13.0	-24.3	309	162	Horizontal
9759	-35.2	-13.0	-22.2	220	100	Vertical

30MHz to 17GHz

No emissions were detected within 22dB of the Peak limit.



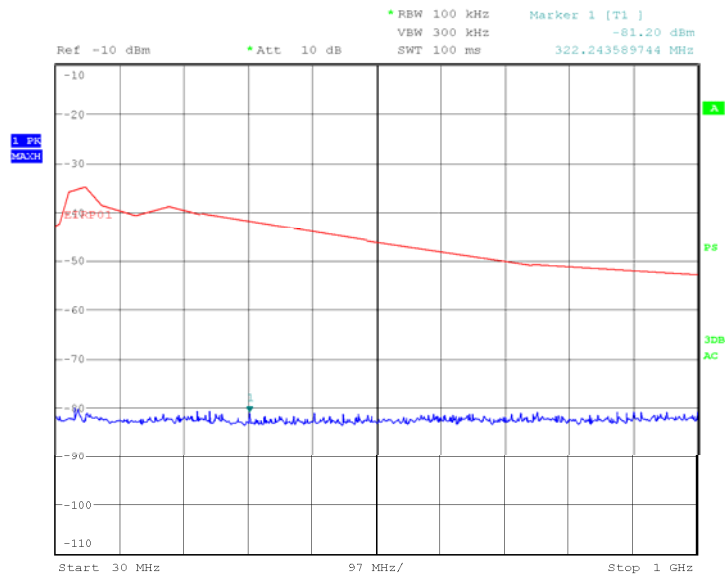
Product Service

Configuration 4 - Mode 1

Top Channel

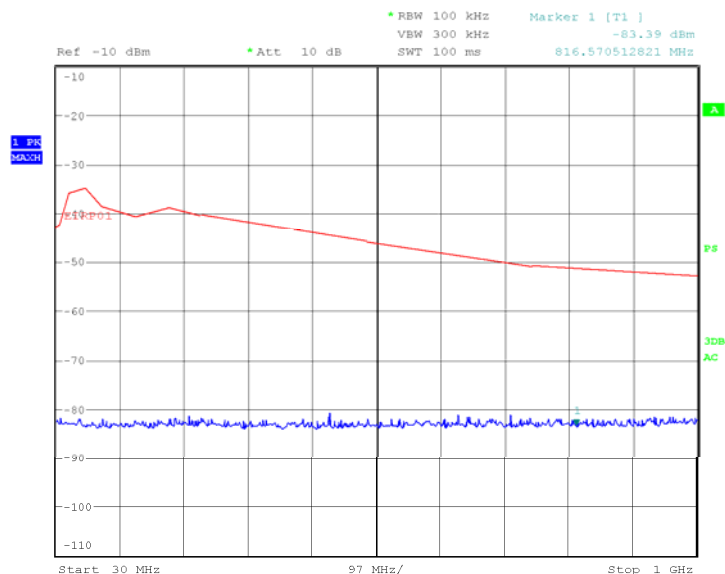
30MHz to 1GHz

Vertical



Date: 29.MAY.2010 22:40:22

Horizontal



Date: 29.MAY.2010 22:35:11



Product Service

Final Result

30MHz to 1GHz

No emissions were detected within 25dB of the Peak limit.

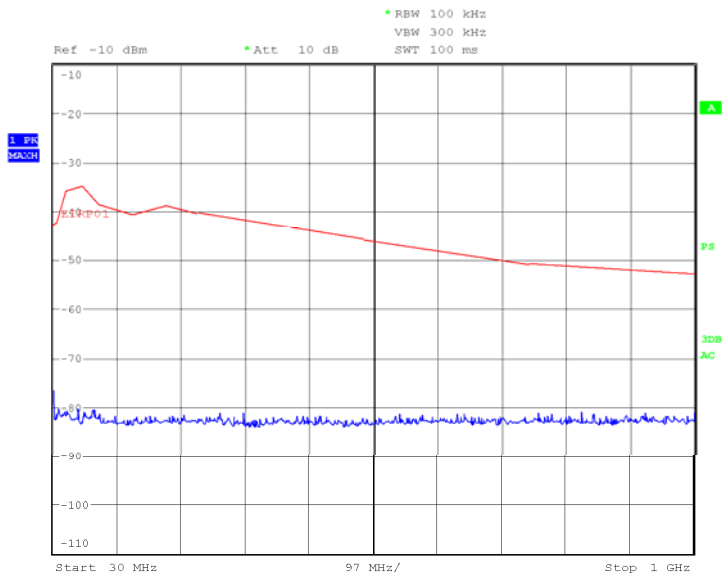


Product Service

Middle Channel

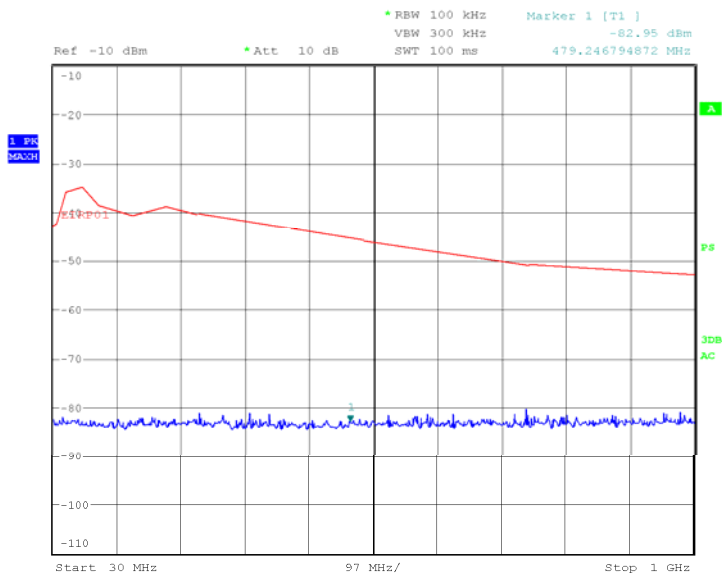
30MHz to 1GHz

Vertical



Date: 29.MAY.2010 21:52:49

Horizontal



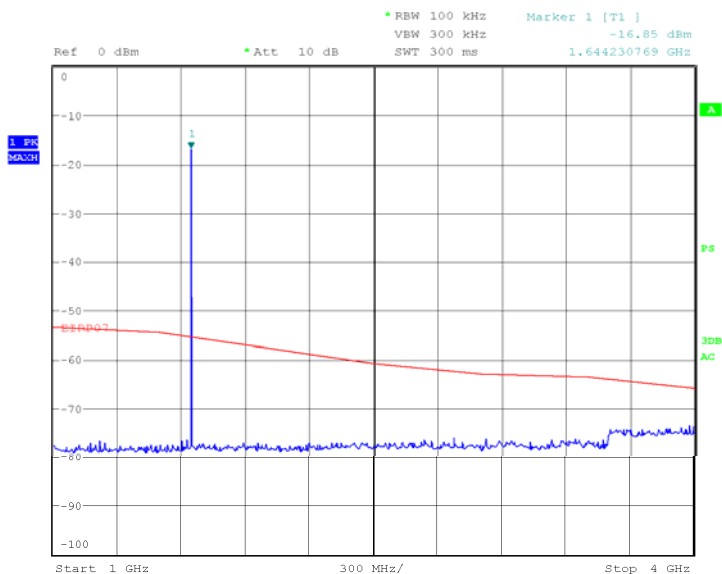
Date: 29.MAY.2010 21:54:00



Product Service

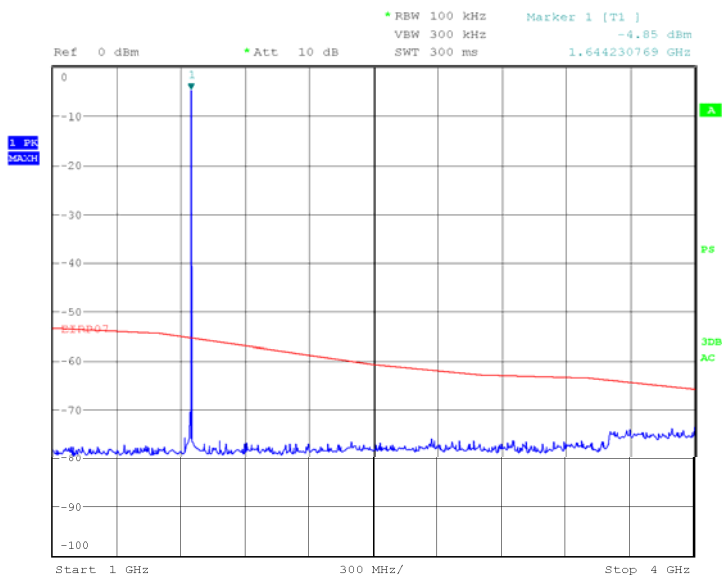
1 GHz to 4 GHz

Vertical



Date: 29.MAY.2010 22:58:56

Horizontal



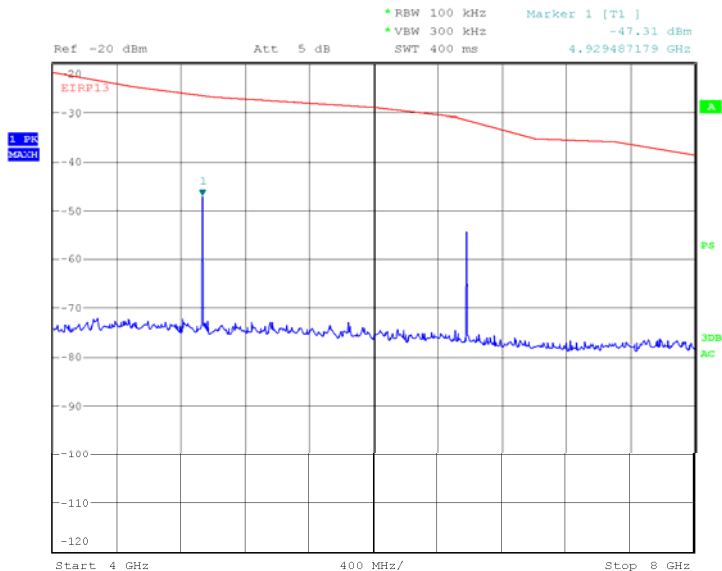
Date: 29.MAY.2010 22:54:11



Product Service

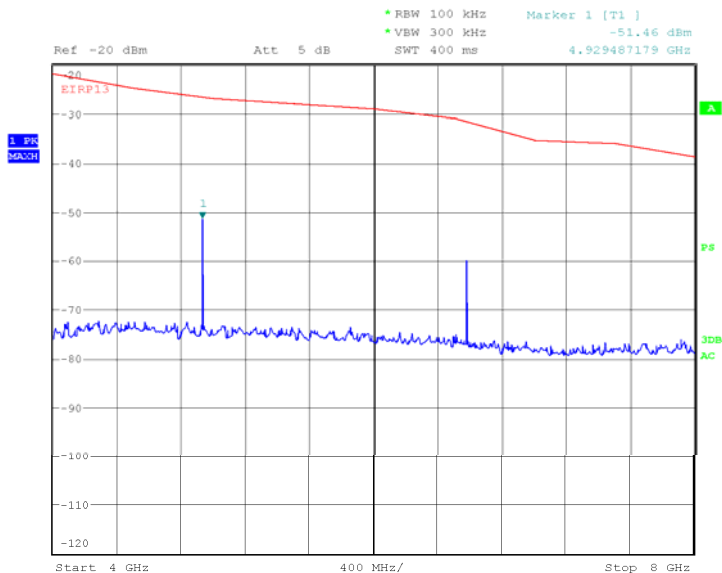
4 GHz to 8 GHz

Vertical



Date: 27.MAY.2010 04:28:29

Horizontal

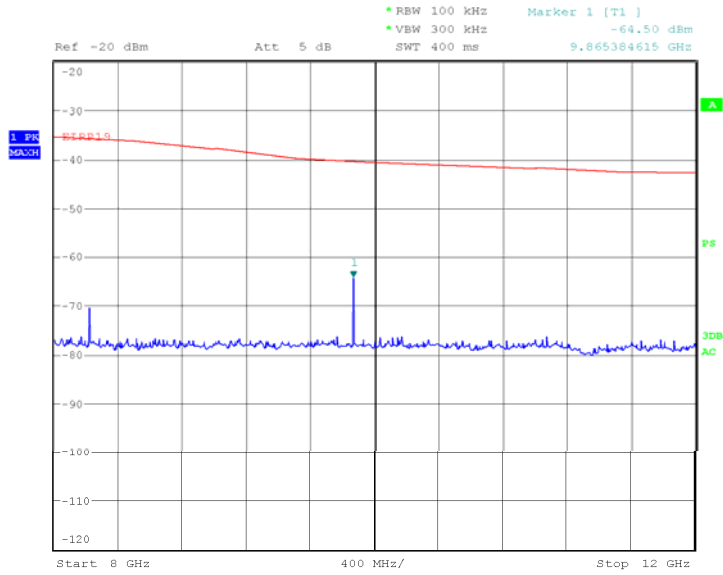


Date: 27.MAY.2010 04:30:53



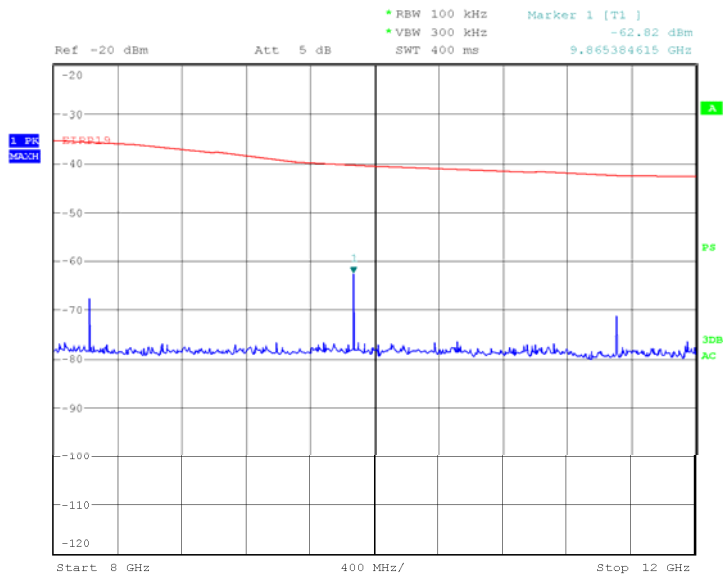
8 GHz to 12 GHz

Vertical



Date: 27.MAY.2010 04:11:53

Horizontal

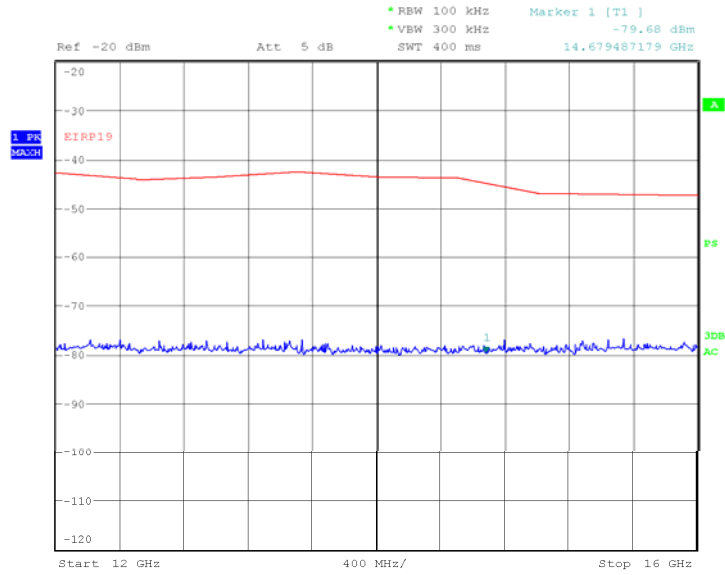


Date: 27.MAY.2010 03:48:51



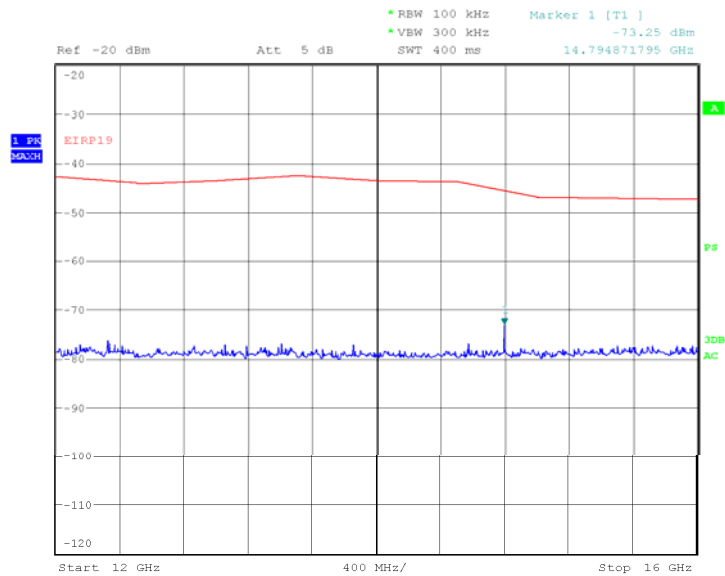
12.5 GHz to 16 GHz

Vertical



Date: 27.MAY.2010 04:06:07

Horizontal

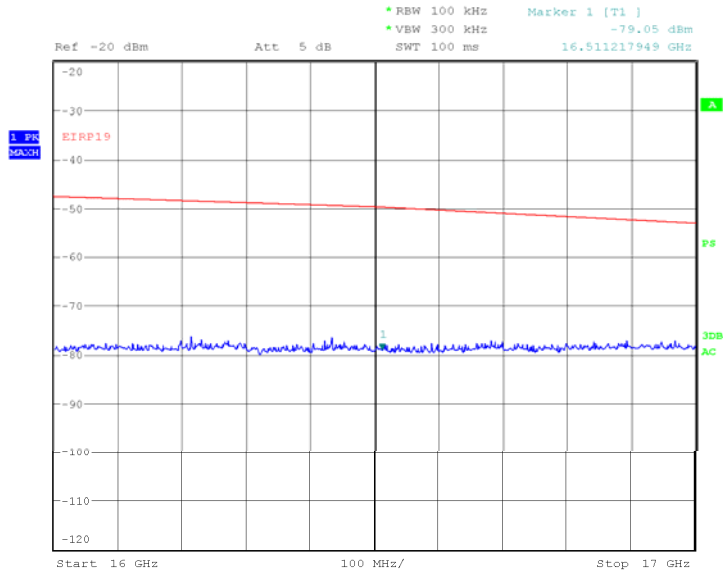


Date: 27.MAY.2010 03:52:27



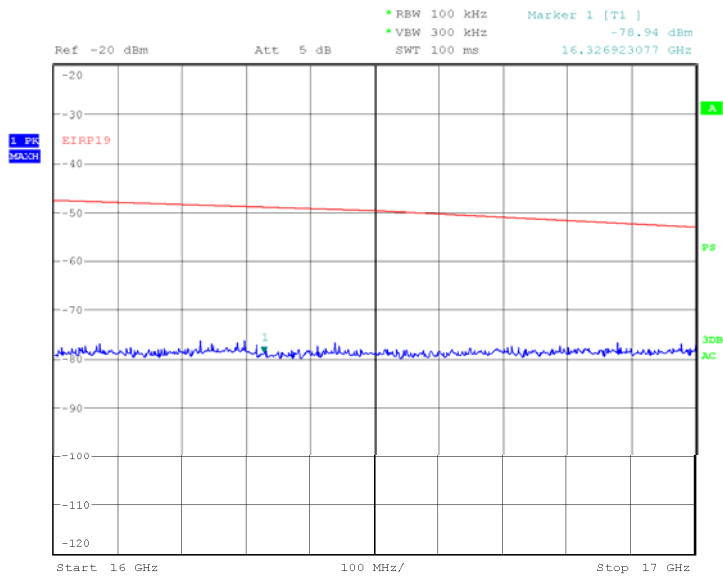
16 GHz to 17 GHz

Vertical



Date: 27.MAY.2010 04:01:50

Horizontal



Date: 27.MAY.2010 03:56:21



Final Result

Frequency (MHz)	Result Peak (dBm)	Limit (dBm)	Margin (dB)	Angle (deg)	Height (m)	Polarity
4931	-33.6	-13.0	-20.6	305	103	Horizontal
4931	-36.4	-13.0	-23.4	31	100	Vertical
6574	-42.1	-13.0	-29.1	117	100	Horizontal
6574	-40.5	-13.0	-27.5	0	117	Vertical
9862	-40.2	-13.0	-27.2	3	100	Vertical
9862	-35.3	-13.0	-22.3	221	151	Horizontal

30MHz to 17GHz

No emissions were detected within 20dB of the Peak limit.

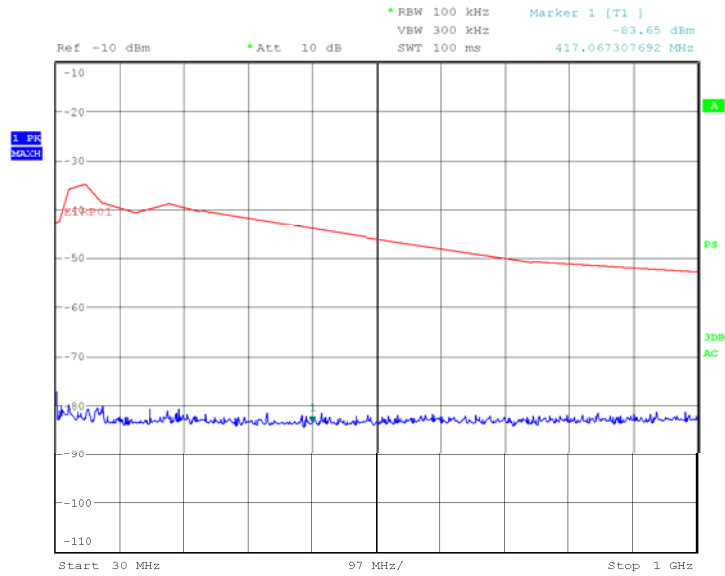


Product Service

Bottom Channel

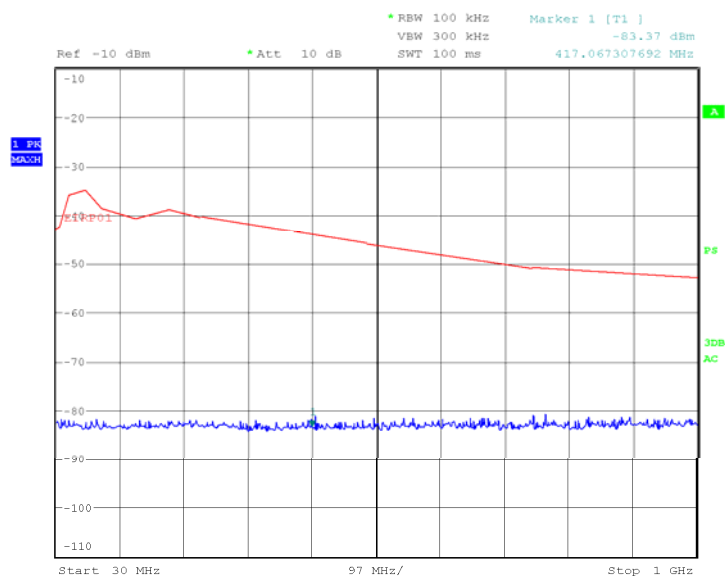
30MHz to 1GHz

Vertical



Date: 29.MAY.2010 22:00:56

Horizontal



Date: 29.MAY.2010 22:02:48



Product Service

Final Result

30MHz to 1GHz

No emissions were detected within 25dB of the Peak limit.



Product Service

2.2 EIRP PEAK POWER

2.2.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1046
 FCC CFR 47 Part 25, Clause 25.204
 RSS-170, Clause Annex B: B1

2.2.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018183

2.2.3 Date of Test and Modification State

30 April, 04 May and 03 June 2010 - 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 ANSI C63.4.

Measurements of the fundamental from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisation. The fundamental frequency was maximised by adjusting the antenna height, antenna polarisation and turntable azimuth. A peak detector was used with the trace set to max hold. The maximum result was recorded.

The EUT was then removed from the chamber and replaced with a substitution antenna. Using a signal generator the level was adjusted to achieve the same value on the measuring instrument as previously recorded with the EUT. The final result was determined by a calculation using the signal generator level, antenna gain and cable loss.

The measurements were performed at a 3m distance unless otherwise stated.

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

Configuration 1 - Mode 1
 Configuration 2 - Mode 1
 Configuration 3 - Mode 1
 Configuration 4 - Mode 1

2.2.6 Environmental Conditions

	30 April 2010	04 May 2010	03 June 2010
Ambient Temperature	20°C	19°C	21.2°C
Relative Humidity	32%	32%	48%
Atmospheric Pressure	1010mbar	1020mbar	1012mbar



2.2.7 Test Results

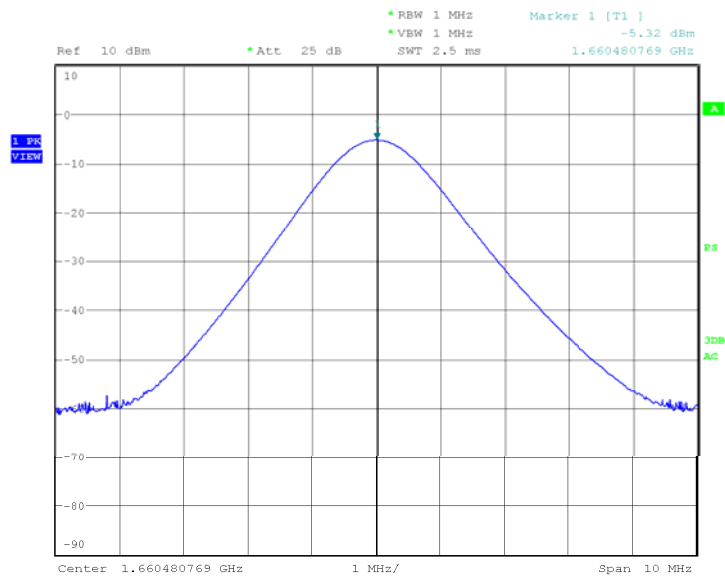
For the period of test the EUT met the requirements of RSS-170 for EIRP Peak Power.

The test results are shown below.

Configuration 1 - Mode 1

Frequency (MHz)	Result (dBm)	Limit (dBm)	Result (W)	Limit (W)
1660.6	37.8	39.0	6.026	7.94
1643.9	37.4	39.0	5.495	7.94
1626.6	38.5	39.0	7.079	7.94

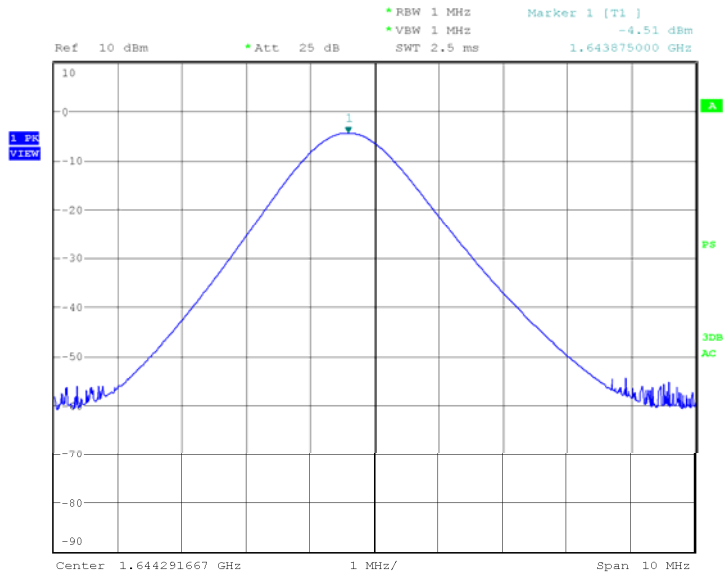
Top Channel



Date: 30.APR.2010 12:04:37

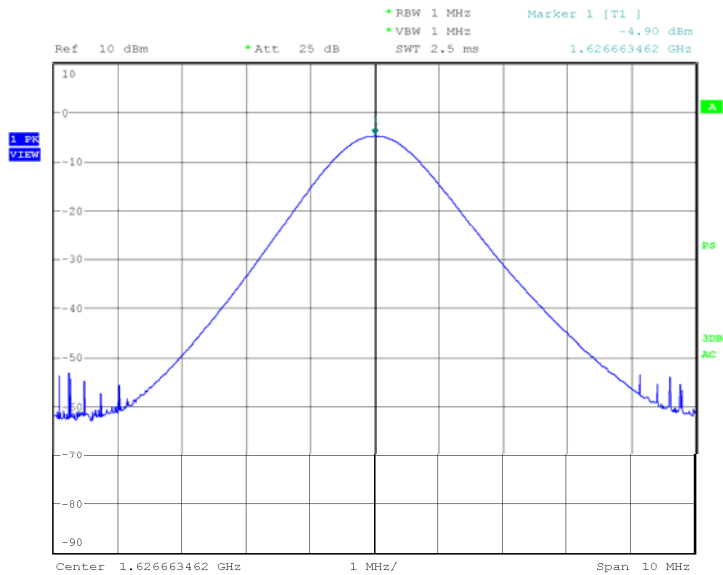


Middle Channel



Date: 30.APR.2010 11:30:47

Bottom Channel



Date: 30.APR.2010 10:55:01

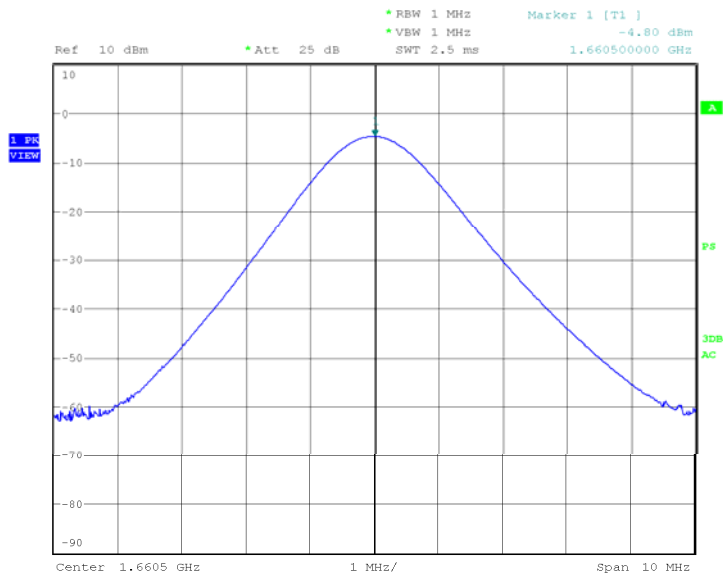


Product Service

Configuration 2 - Mode 1

Frequency (MHz)	Result (dBm)	Limit (dBm)	Result (W)	Limit (W)
1660.6	38.3	39.0	6.761	7.94
1643.9	36.7	39.0	4.677	7.94
1626.6	38.7	39.0	7.413	7.94

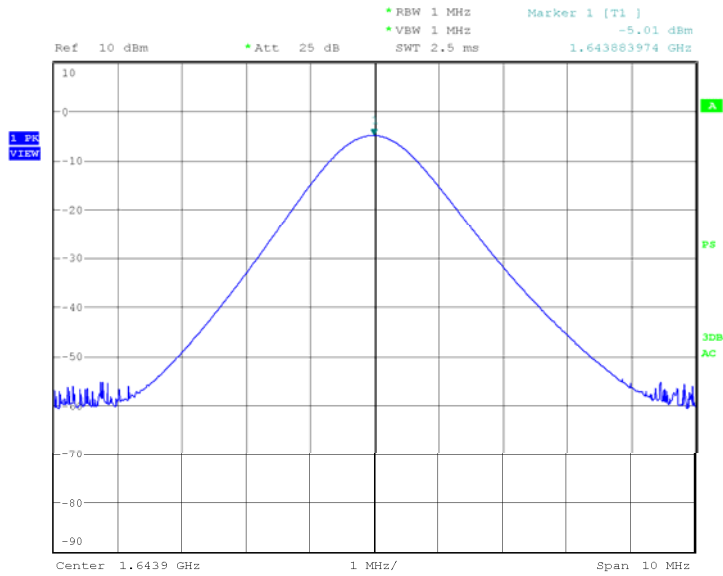
Top Channel



Date: 4.MAY.2010 10:07:31

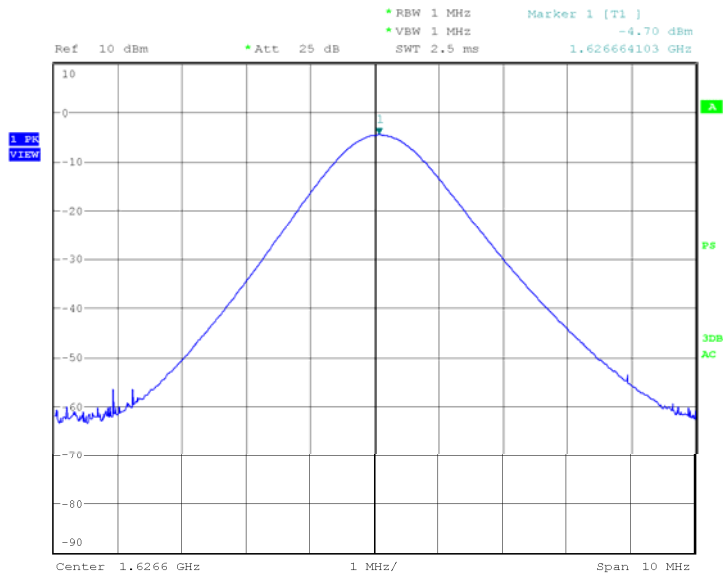


Middle Channel



Date: 30.APR.2010 14:37:31

Bottom Channel



Date: 30.APR.2010 13:16:17

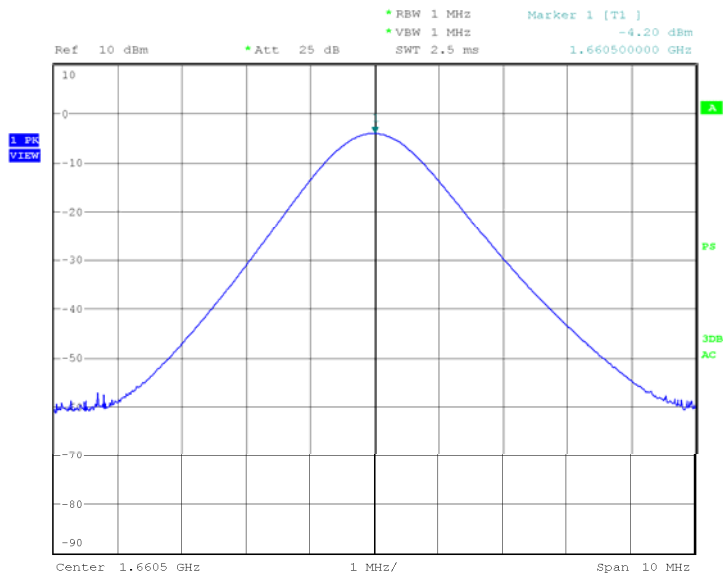


Product Service

Configuration 3 - Mode 1

Frequency (MHz)	Result (dBm)	Limit (dBm)	Result (W)	Limit (W)
1660.6	38.9	39.0	7.762	7.94
1643.9	38.0	39.0	6.309	7.94
1626.6	38.6	39.0	7.244	7.94

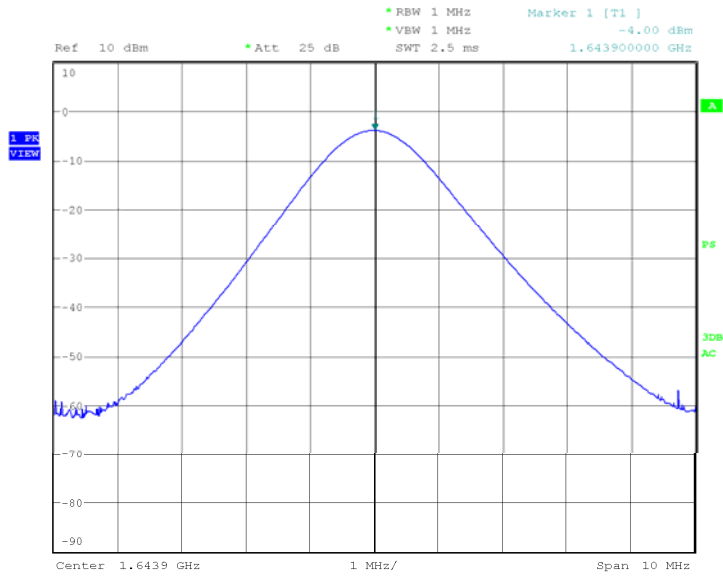
Top Channel



Date: 4.MAY.2010 11:08:05

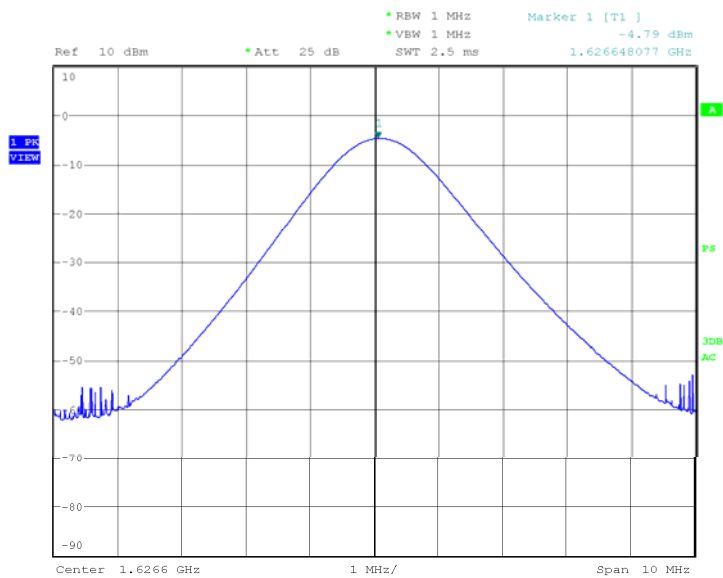


Middle Channel



Date: 4.MAY.2010 10:59:43

Bottom Channel



Date: 4.MAY.2010 10:46:26

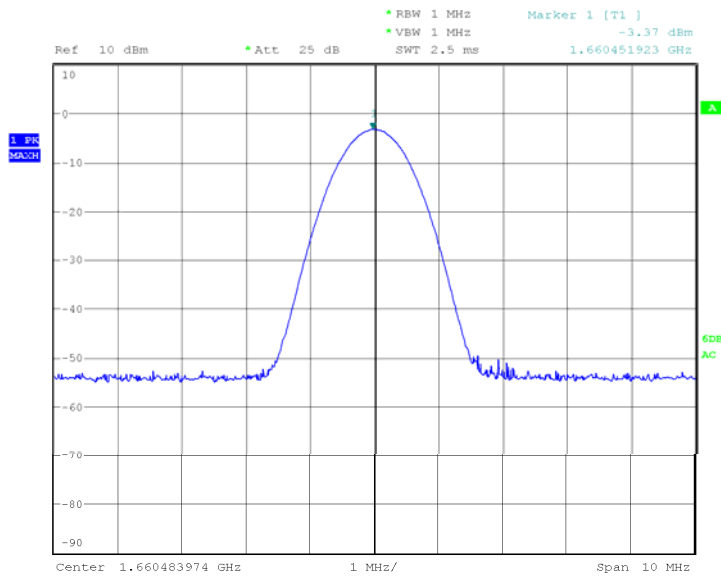


Product Service

Configuration 4 - Mode 1

Frequency (MHz)	Result (dBm)	Limit (dBm)	Result (W)	Limit (W)
1660.6	37.7	39.0	5.888	7.94
1643.9	38.0	39.0	6.309	7.94
1626.6	36.8	39.0	4.786	7.94

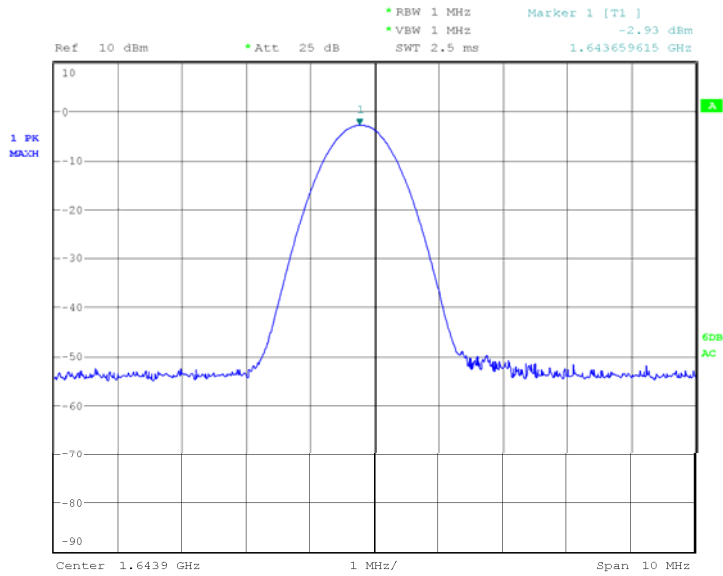
Top Channel



Date: 3.JUN.2010 11:11:26

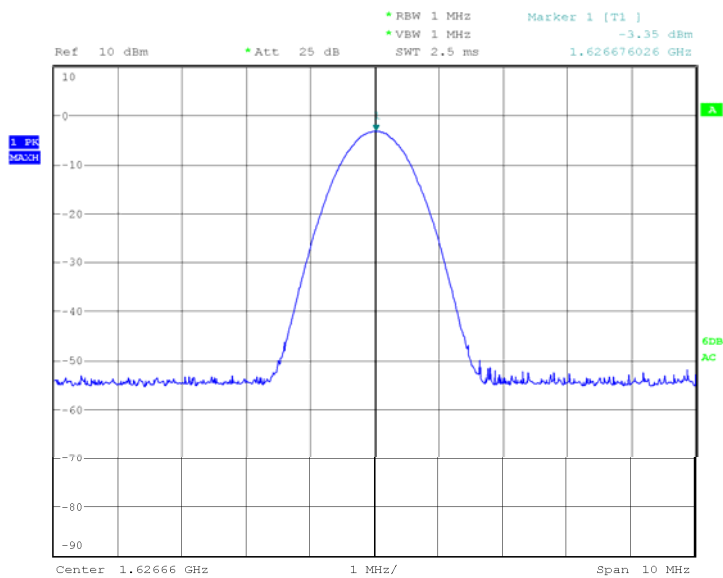


Middle Channel



Date: 3.JUN.2010 10:53:27

Bottom Channel



Date: 3.JUN.2010 10:19:44



Product Service

2.3 SPURIOUS EMISSIONS (CONDUCTED)

2.3.1 Specification Reference

FCC CFR 47 Part 25, Clause 25.202(f)

2.3.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018258

2.3.3 Date of Test and Modification State

26 April 2010 - 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

In accordance with Part 25.202(f) 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 17 GHz. The EUT was set to transmit on full power. The spectrum analyser detector was set to Max Hold. (Worst case)

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 1

2.3.6 Environmental Conditions

	26 April 2010
Ambient Temperature	22°C
Relative Humidity	35%



Product Service

2.3.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 25 for Spurious Emissions (Conducted).

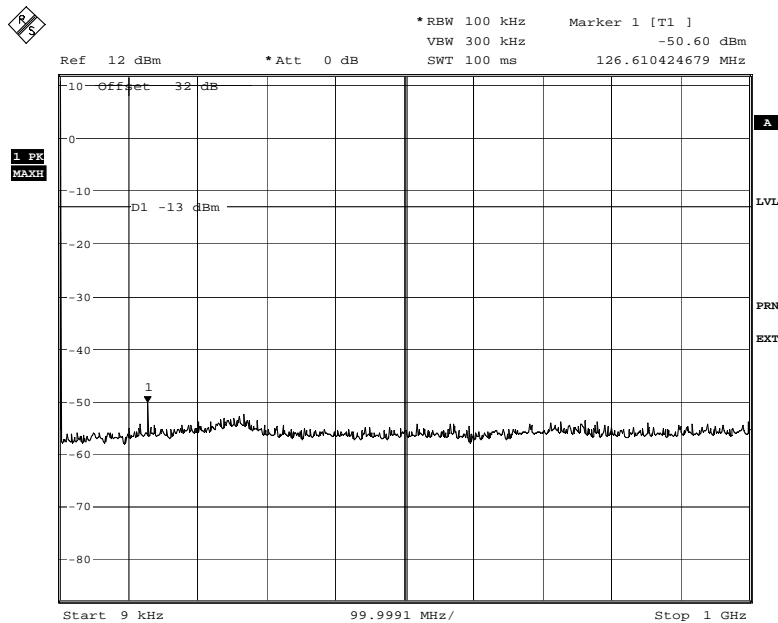
The test results are shown below.

Configuration 1 - Mode 1

3.7 V DC Supply

1626.675 MHz

9kHz to 1GHz

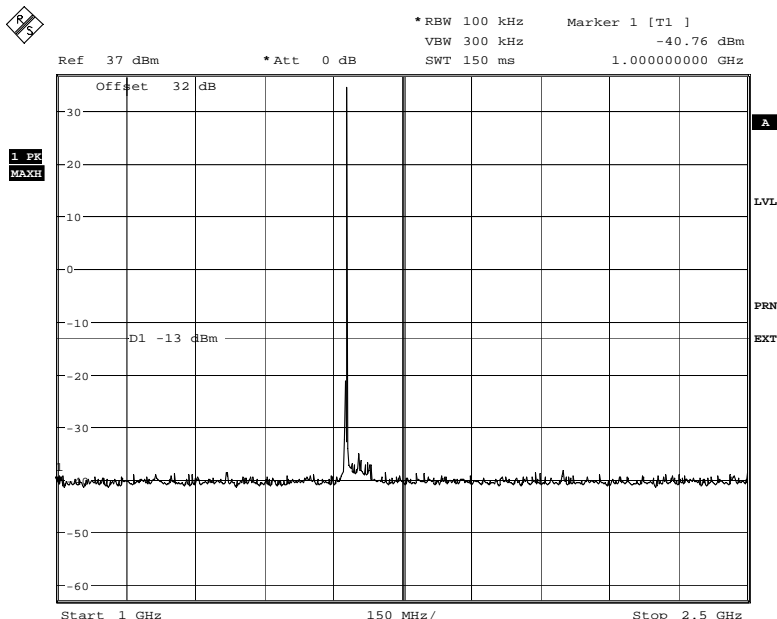


Date: 26.APR.2010 16:29:19



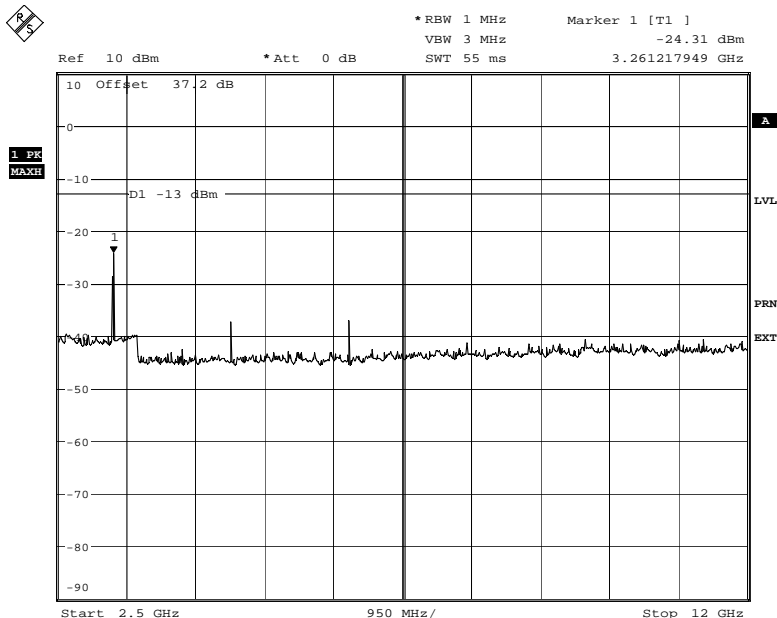
Product Service

1GHz to 2.5GHz



Date: 26.APR.2010 16:45:02

2.5GHz to 12GHz

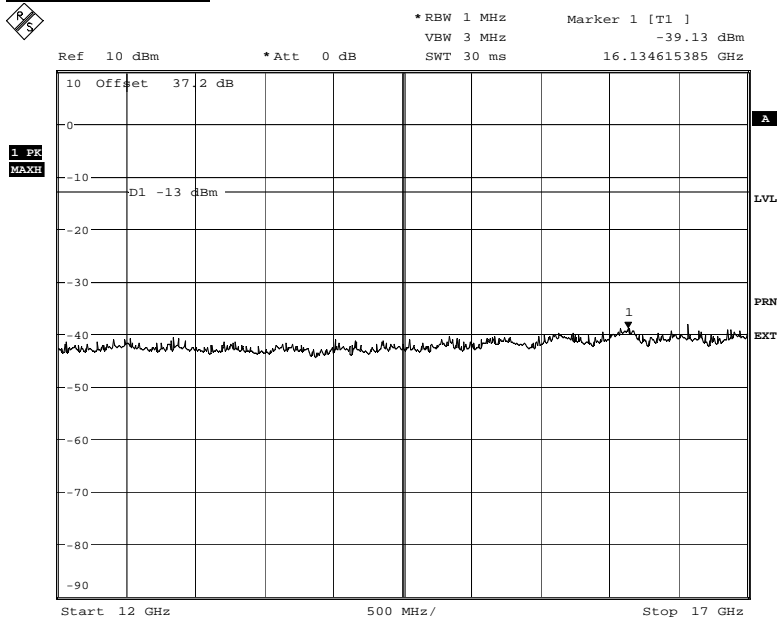


Date: 26.APR.2010 16:48:39



Product Service

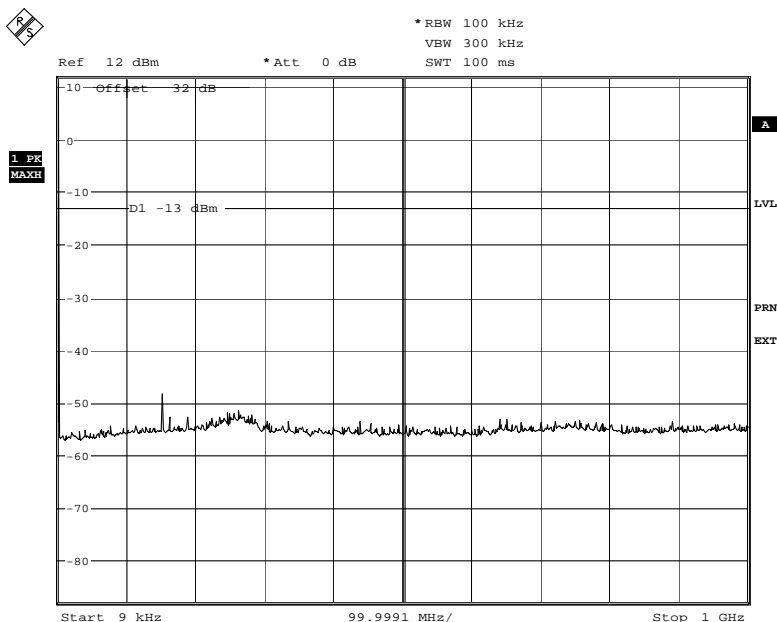
12GHz to 17GHz



Date: 26.APR.2010 17:04:56

1643.675 MHz

9kHz to 1GHz

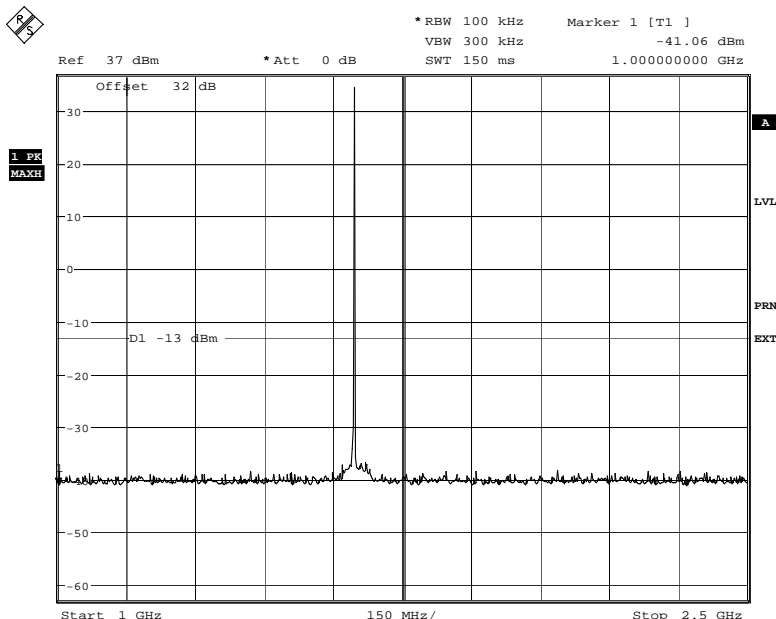


Date: 26.APR.2010 16:28:24



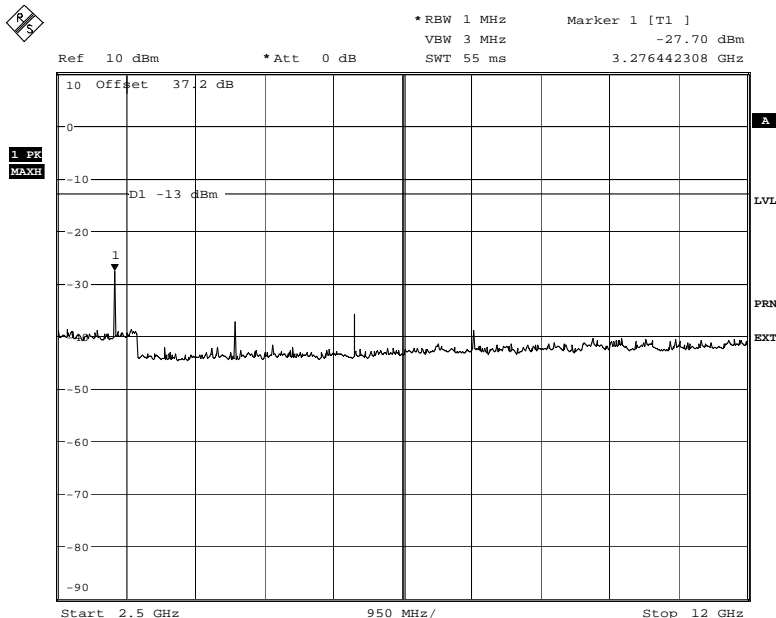
Product Service

1GHz to 2.5GHz



Date: 26.APR.2010 16:43:51

2.5GHz to 12GHz

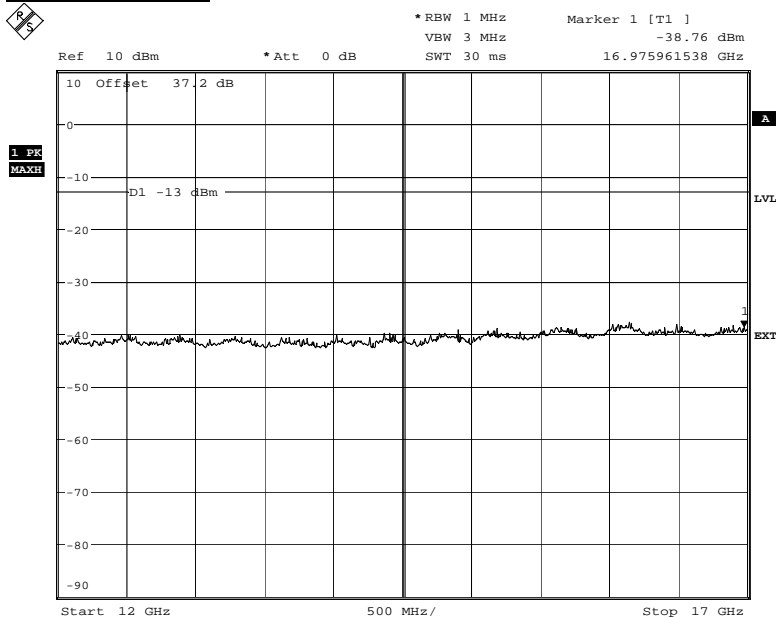


Date: 26.APR.2010 16:53:39



Product Service

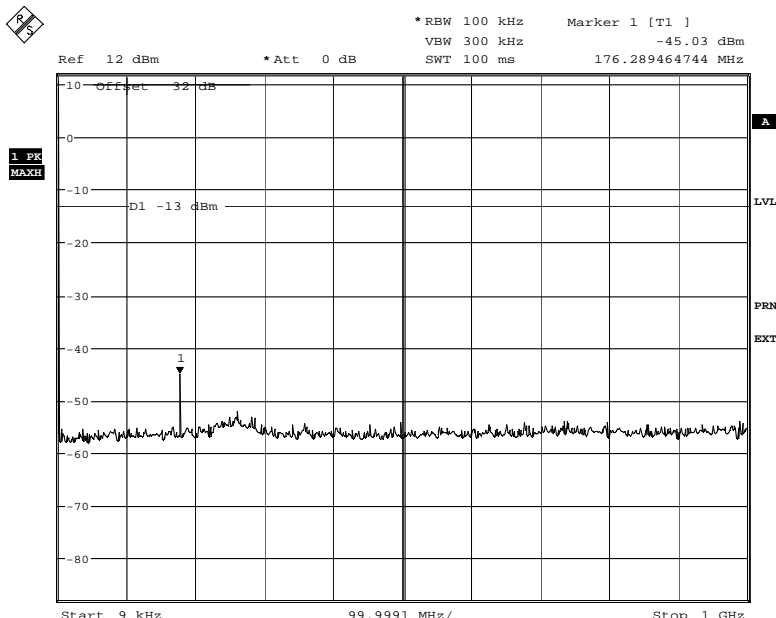
12GHz to 17GHz



Date: 26.APR.2010 17:04:07

1660.475 MHz

9kHz to 1GHz

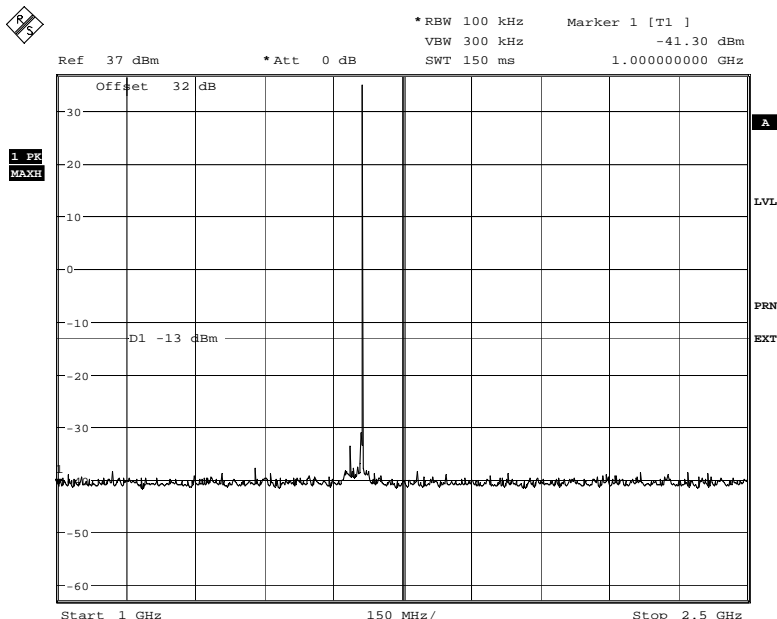


Date: 26.APR.2010 16:38:39



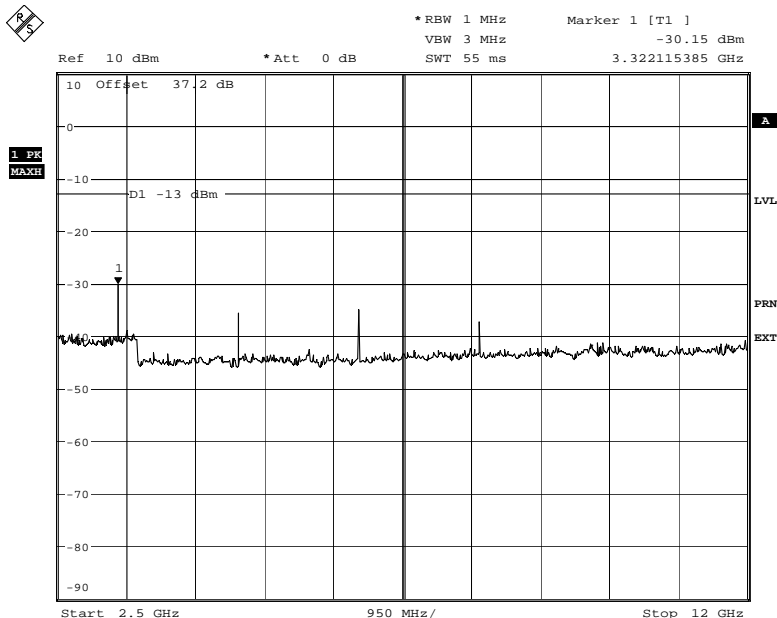
Product Service

1GHz to 2.5GHz



Date: 26.APR.2010 16:41:49

2.5GHz to 12GHz

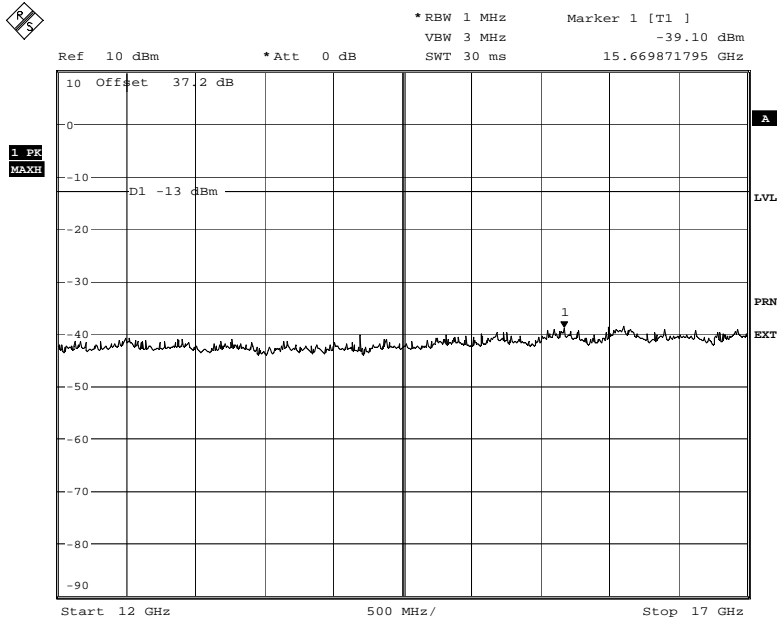


Date: 26.APR.2010 17:05:50



Product Service

12GHz to 17GHz



Date: 26.APR.2010 16:56:00

Limit Clause

25.202(f)(3)

>25% Authorised Bandwidth	$43 + 10\log P$
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Product Service

2.4 SPURIOUS EMISSIONS (CONDUCTED)

2.4.1 Specification Reference

FCC CFR 47 Part 25, Clause 25.216(h)

2.4.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018340

2.4.3 Date of Test and Modification State

10 June 2010 - 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 EUT was connected to a spectrum analyser via a cable and 30dB attenuator. The worst case path loss was measured and entered as a reference level offset into the spectrum analyser. The EUT was set to transmit at maximum power on bottom, middle and top channels with modulation representative of normal use with a symbol rate of 67.208 kb/s. The spectrum analyser detector was set to RMS and the trace averaged using an RBW of 1MHz. The spectrum analyser was gated over a 2ms period of the transmit signal as defined in 25.216(h).

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

Configuration 1 - Mode 1

2.4.6 Environmental Conditions

	10 June 2010
Ambient Temperature	21°C
Relative Humidity	51%



2.4.7 Test Results

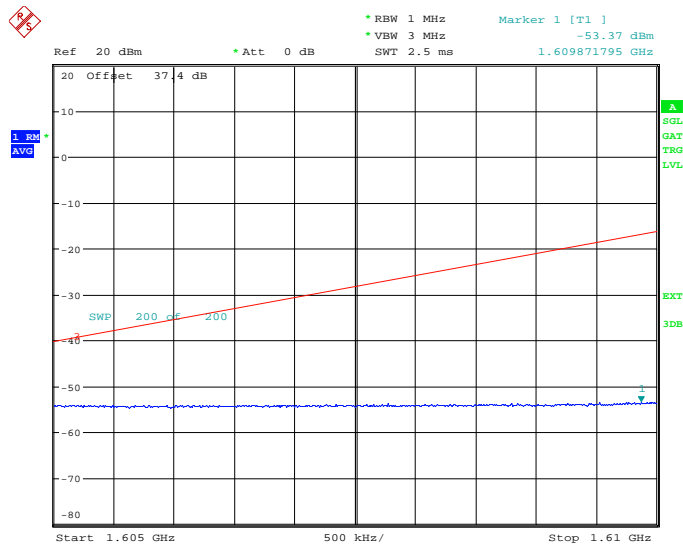
For the period of test the EUT met the requirements of FCC CFR 47 Part 25 for Spurious Emissions (Conducted).

The test results are shown below.

Configuration 1 - Mode 1

3.7 V DC Supply

Top Channel

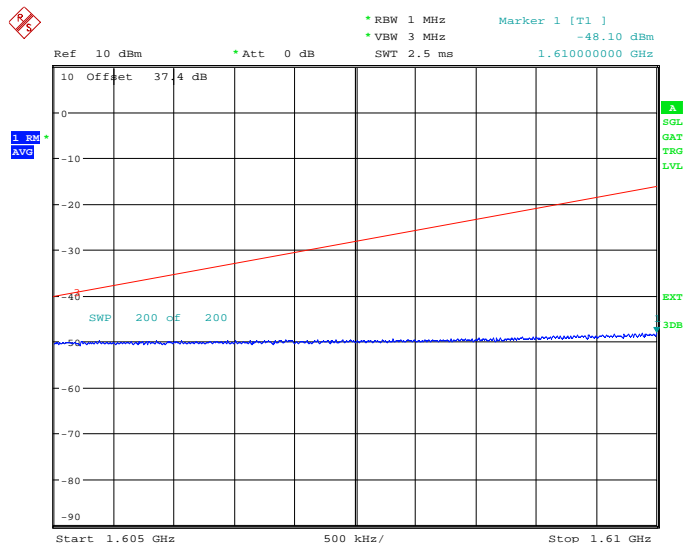


OBW1
Date: 10.JUN.2010 16:28:03



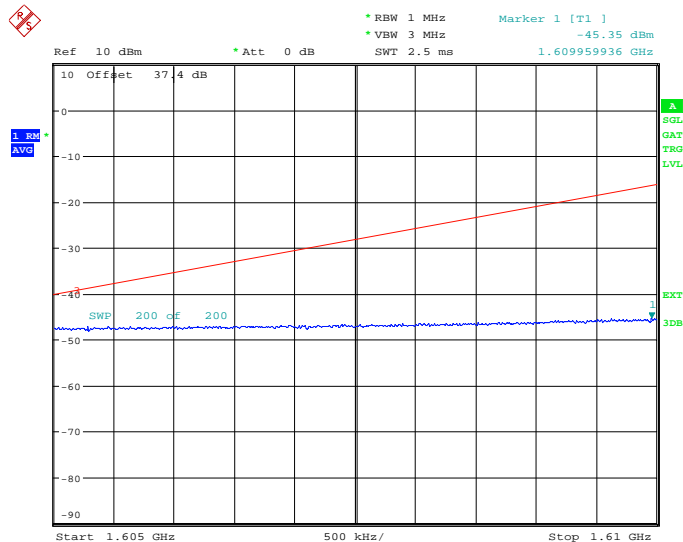
Product Service

Middle Channel



OBW1
Date: 10.JUN.2010 16:24:06

Bottom Channel



OBW1
Date: 10.JUN.2010 16:23:04

Limit Clause

25.216(h)

Frequency Range	Limit
1605 – 1610 MHz	-70dBW/MHz at 1605MHz to -46dBW/MHz at 1610MHz



Product Service

2.5 SPURIOUS EMISSIONS (CONDUCTED)

2.5.1 Specification Reference

FCC CFR 47 Part 25, Clause 25.216(i)

2.5.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018340

2.5.3 Date of Test and Modification State

10 June 2010 - 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 EUT was connected to a spectrum analyser via a 10dB attenuator and cable. The worst case path loss was measured and entered as a reference level offset into the spectrum analyser. The EUT was set to its carrier off state. The spectrum analyser detector was set to rms and the trace averaged using a RBW of 1MHz.

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

Configuration 1 - Mode 2

2.5.6 Environmental Conditions

10 June 2010

Ambient Temperature 21°C

Relative Humidity 51%



Product Service

2.5.7 Test Results

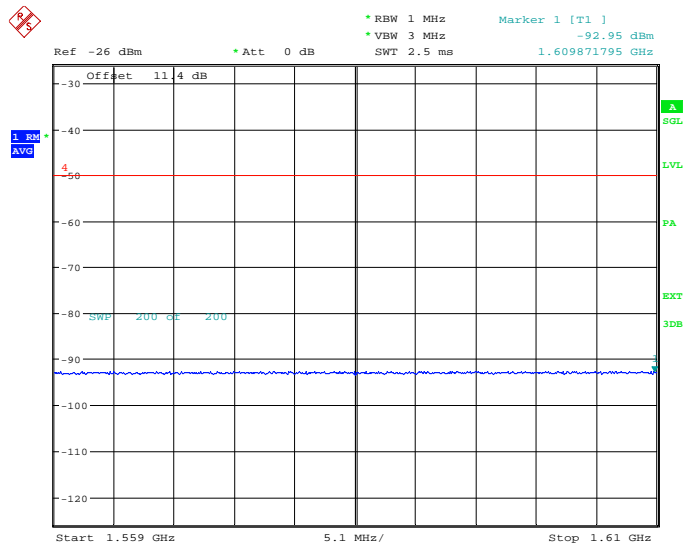
For the period of test the EUT met the requirements of FCC CFR 47 Part 25 for Spurious Emissions (Conducted).

The test results are shown below.

Configuration 1 - Mode 2

3.7 V DC Supply

1559 to 1610 MHz



OBW1
 Date: 10.JUN.2010 16:34:49

Limit Clause

25.216(i)

Frequency Range	Limit
1559 – 1610 MHz	-80dBW/MHz



Product Service

2.6 SPURIOUS EMISSIONS

2.6.1 Specification Reference

RSS-170, Clause Annex B: B2

2.6.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018258

2.6.3 Date of Test and Modification State

05 May 2010 - 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 EUT was connected to a spectrum analyser via a cable and 30dB attenuator. The worst case path loss was measured and entered as a reference level offset into the spectrum analyser. The EUT was set to transmit at maximum power on bottom and top channels with modulation representative of normal use with a symbol rate, of 67.208 ks/s. The EUT utilises a TDMA system and therefore the detector was set to peak and the trace to max hold, (worst case). As it was not possible to select a 4kHz RBW as defined in Table B2, the closest larger RBW of 10kHz was selected, (worst case).

Where emissions shown in the plots exceed the specification, the marker noise function was used showing the result in dBm/Hz. The displayed result should be corrected by 36dB to give the result in a 4kHz bandwidth as defined in the specification.

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

Configuration 1 - Mode 1

2.6.6 Environmental Conditions

	05 May 2010
Ambient Temperature	22°C
Relative Humidity	31%



Product Service

2.6.7 Test Results

For the period of test the EUT met the requirements of RSS-170 for Spurious Emissions.

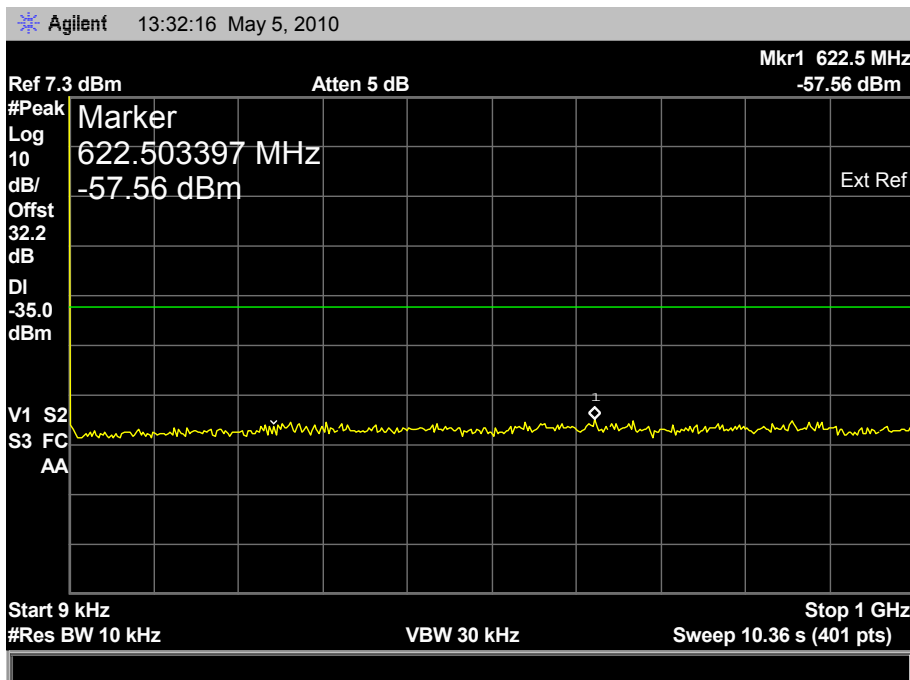
The test results are shown below.

Configuration 1 - Mode 1

3.7 V DC Supply

1626.675 MHz

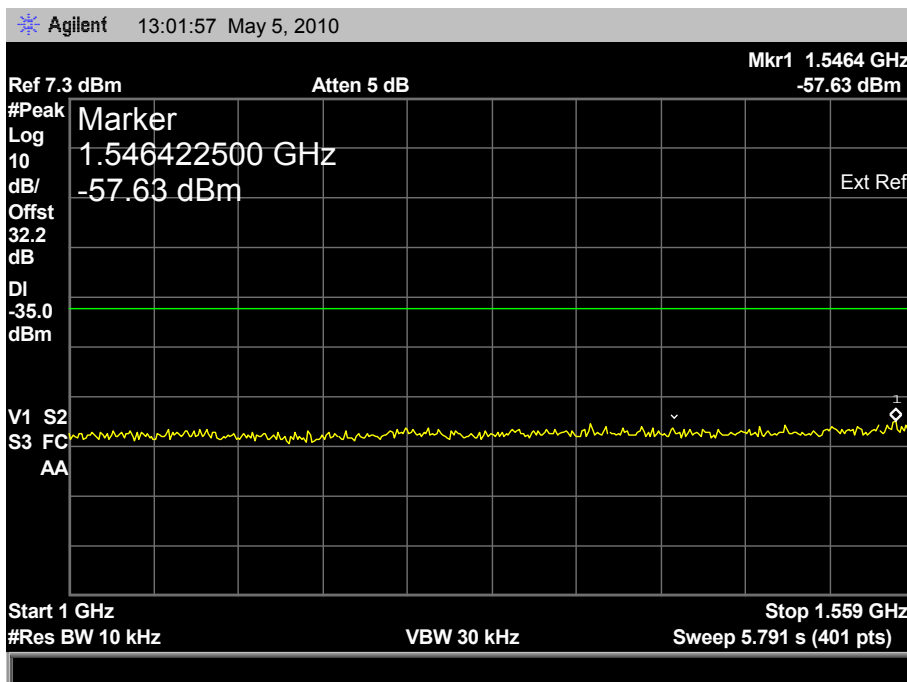
9kHz to 1GHz



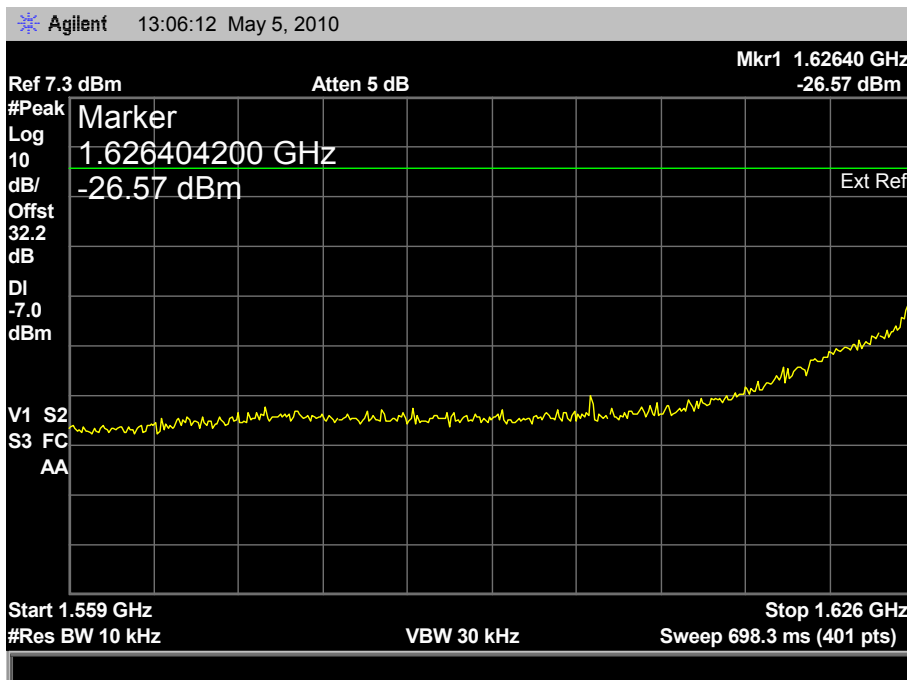


Product Service

1GHz to 1.559GHz



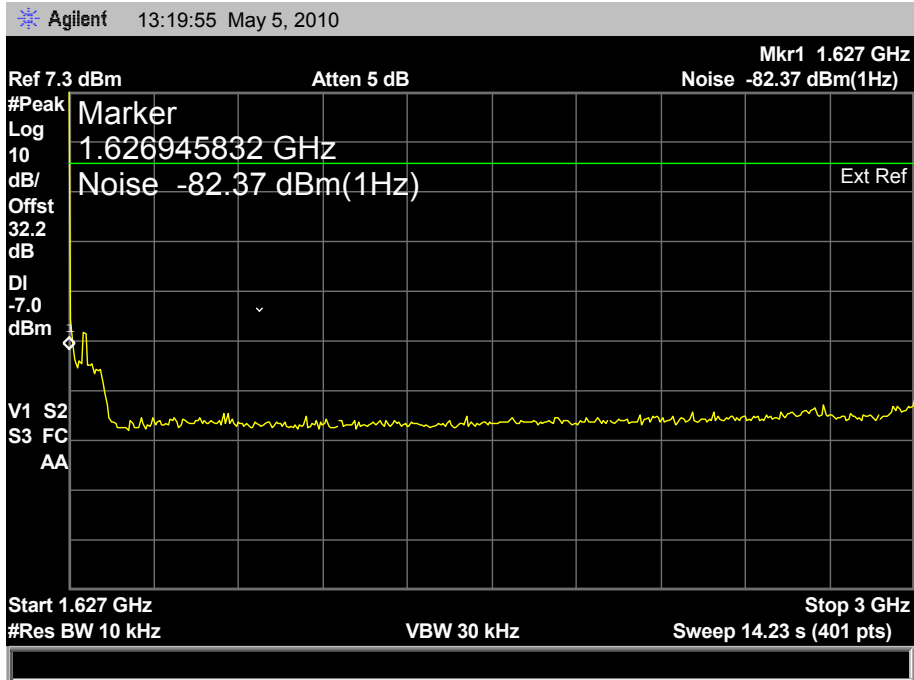
1.559GHz to 1.6264GHz



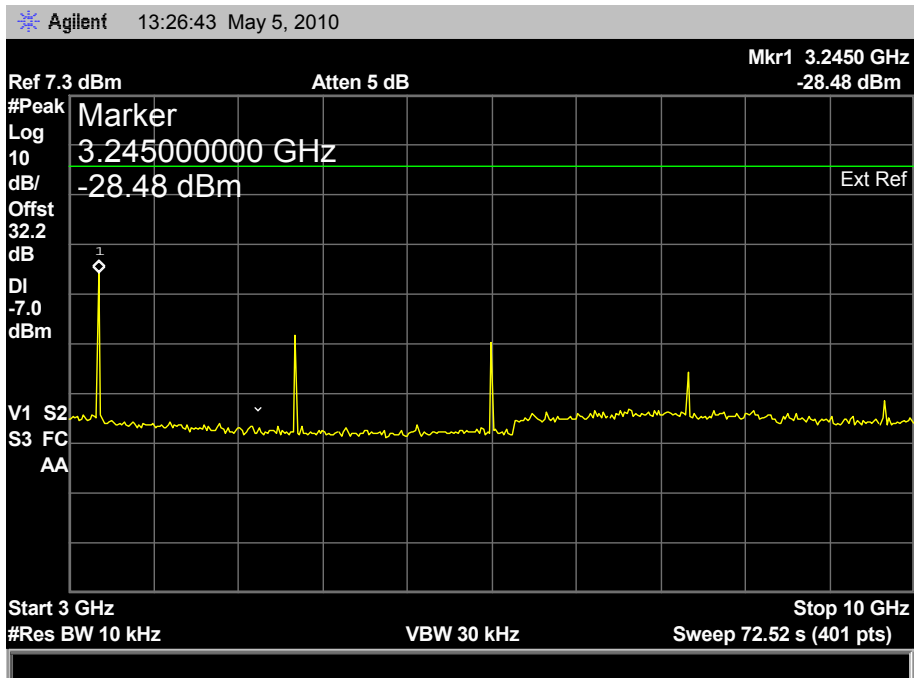


Product Service

1.626945832GHz to 3GHz



3GHz to 10GHz

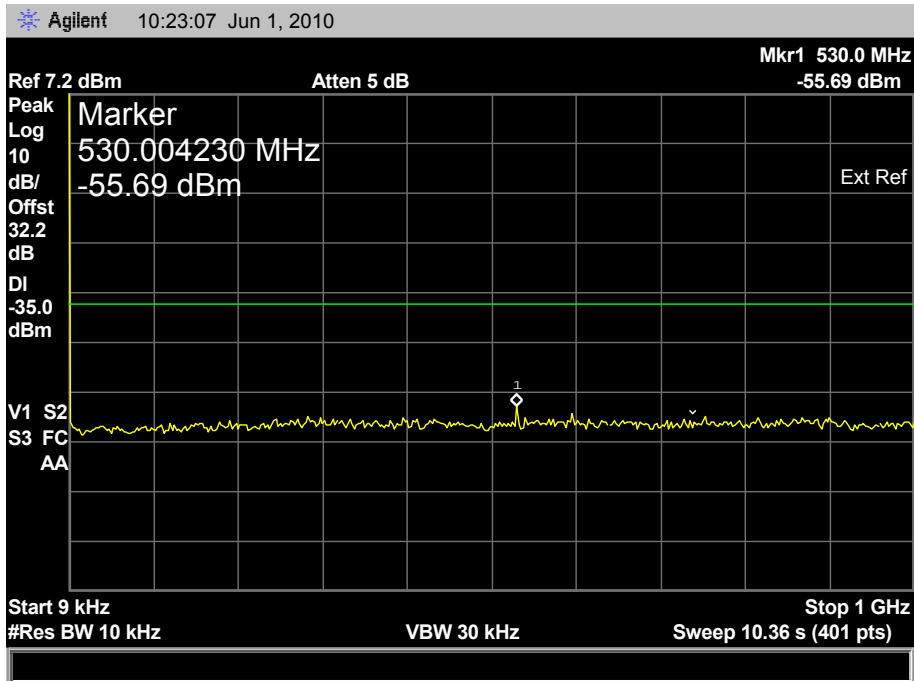




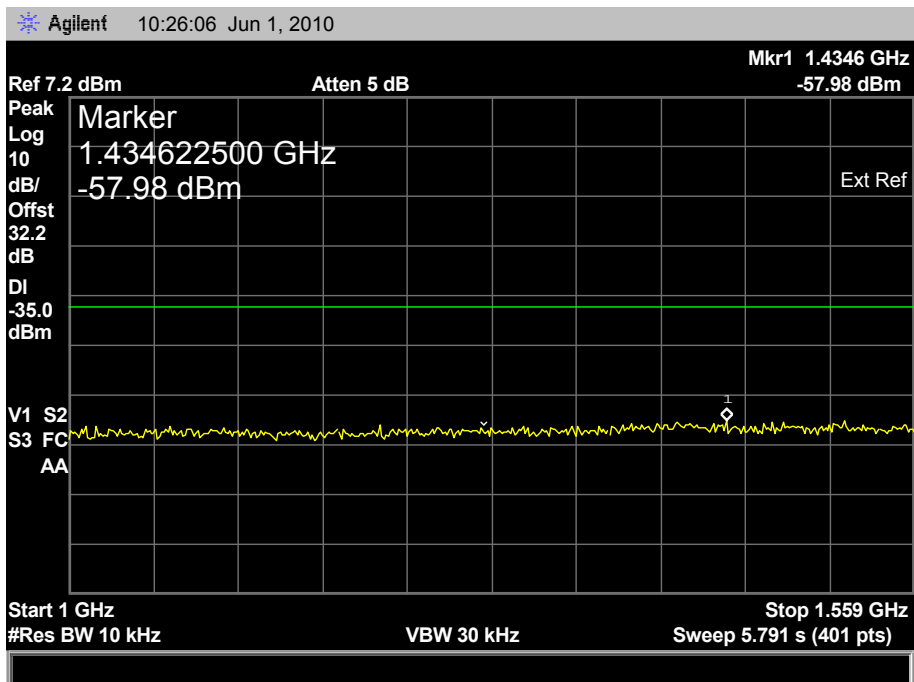
Product Service

1660.475 MHz

9kHz to 1GHz



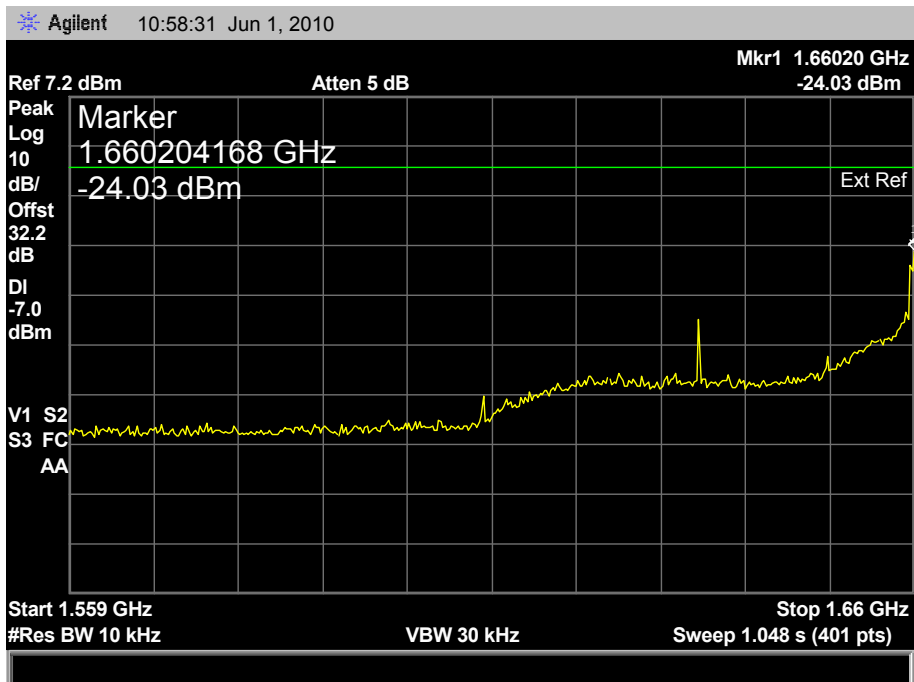
1GHz to 1.559GHz



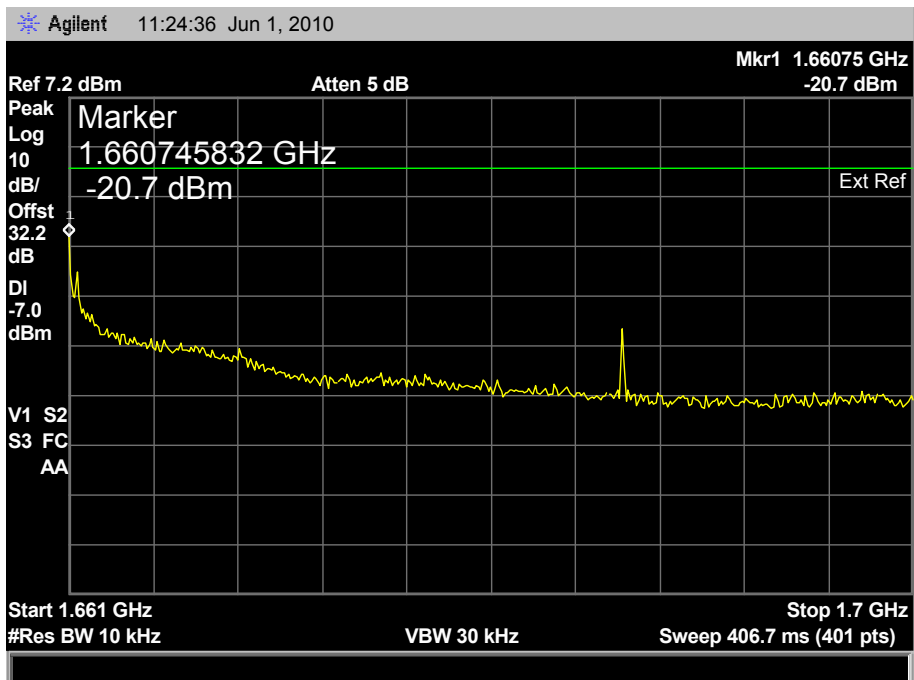


Product Service

1.559GHz to 1.660204168GHz



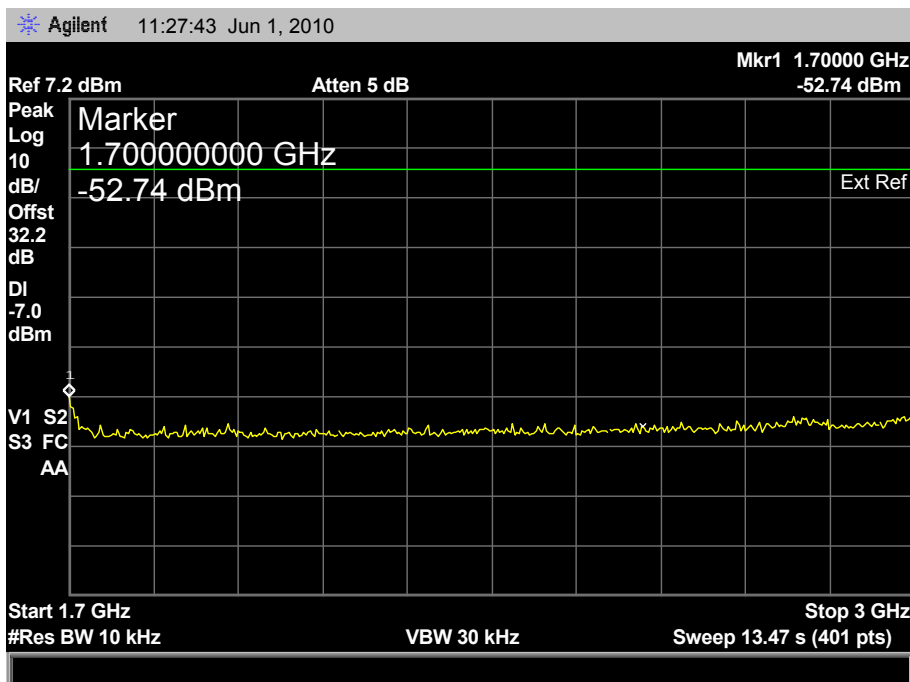
1.660745832GHz to 1.770 GHz



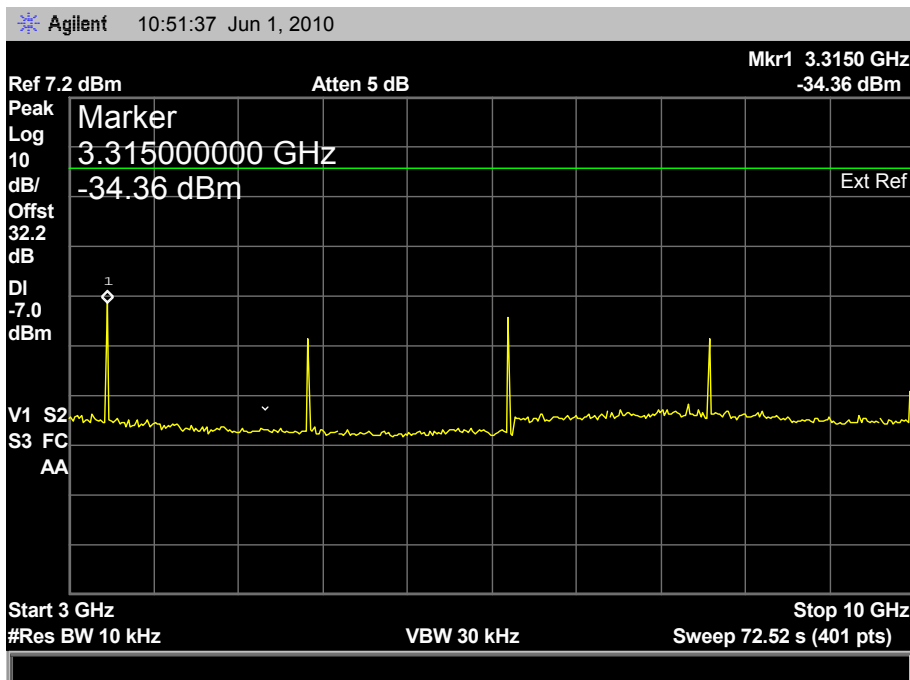


Product Service

1.700GHz to 3.0 GHz



3.0GHz to 10 GHz





Product Service

Limit Clause

Annex B: B2 RSS-170

Frequency (MHz)	Minimum Attenuation Relative to Transmit Power in Any 4kHz
30 - 1559	83dB or $(65 + 10\log T_p)$ dB whichever is less stringent
>1559	55dB or $(37 + 10\log T_p)$ dB whichever is less stringent



Product Service

2.7 EMISSION MASK

2.7.1 Specification Reference

RSS-170, Clause Annex B: B2

2.7.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018258

2.7.3 Date of Test and Modification State

06 May 2010 - Modification State 1

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 EUT was connected to a spectrum analyser via cable and attenuators. Emission Mask (b) from Table B1 was used. It was not possible to set a 4kHz RBW on the instrumentation, so the closest larger RBW of 5kHz was selected. Using an RMS detector, trace averaging and utilising an externally gated trigger, the EUT was assessed against the mask for compliance over 100 sweeps. The EUT was tested at bottom and top channels with modulation at a symbol rate of 67.708kHz.

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

Configuration 1 - Mode 1

2.7.6 Environmental Conditions

06 May 2010

Ambient Temperature 23°C

Relative Humidity 34%



Product Service

2.7.7 Test Results

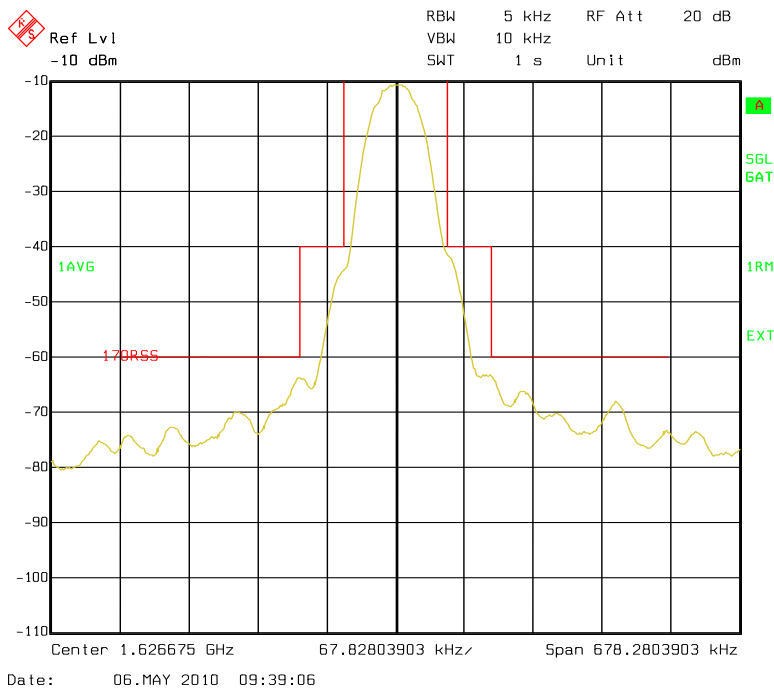
For the period of test the EUT met the requirements of RSS-170 for Emission Mask.

The test results are shown below.

Configuration 1 - Mode 1

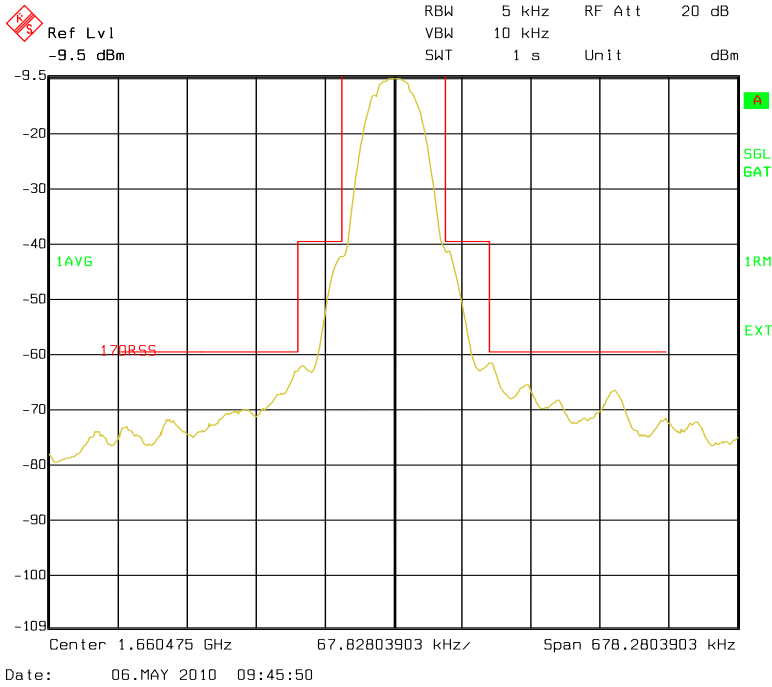
3.7 V DC Supply

1626.675 MHz





1660.475 MHz



Limit Clause

Annex B: B2

Frequency Offset Normalised to SR (Symbol Rate)	(a) Minimum Attenuation Relative to in-band Spectral Density (dBc)	(b) Minimum Attenuation Relative to Transmitter Output Power (dBc) in any 4kHz
±0.75	0	0
±1.40	-20	-30
±2.80	-40	-50
±4.00	-55 or (37 + 10logTp) whichever is less stringent	65 or (47 + 10logTp) whichever is less stringent



Product Service

2.8 EMISSION MASK

2.8.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 25, Clause 25.202(f)(1)(2)

2.8.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018217

2.8.3 Date of Test and Modification State

26 May 2010 - 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 EUT was connected to a spectrum analyser via 30dB of attenuation. The RBW was set to 3kHz and the VBW to 10kHz. A correction factor of 1.25dB was added to the reference level offset to account for the RBW being 3kHz not 4kHz as defined in 25.202(f). Also included in the reference level offset were the antenna gain, (3.5dBi) and the pass loss between the spectrum analyser and the EUT. The reference level offset was established by measuring the wideband power using a power meter averaging over the burst length. The emission mask was based on an authorised bandwidth of 100kHz as defined by the satellite service provider. Measurements of the emission mask were performed using an RMS detector with trace averaging over 50 sweeps with a gated trigger ensuring averaging was only performed with the transmit signal active. Measurements were performed on bottom, middle and top channels. The plots are on the following pages.

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

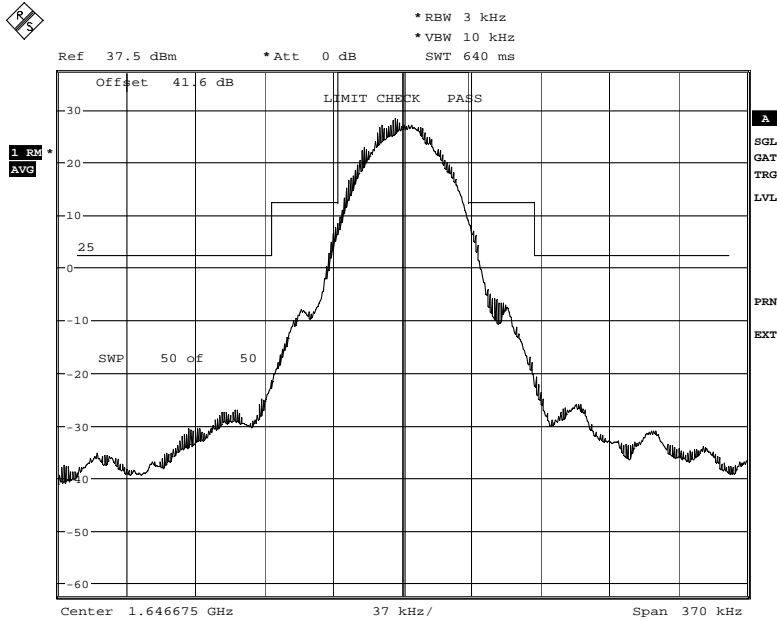
Configuration 1 - Mode 1

2.8.6 Environmental Conditions

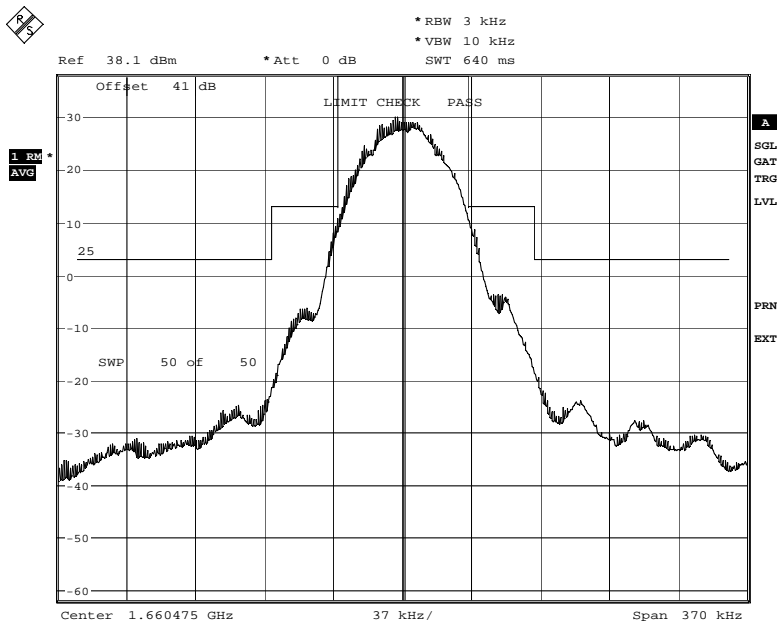
	26 May 2010
Ambient Temperature	25°C
Relative Humidity	30%



1646.675 MHz



1660.475 MHz





Product Service

Limit Clause

25.202(f)(1)(2)

Frequency Range	Attenuation in 4kHz Bandwidth
50 to 100% Authorised Bandwidth	25dB
100 to 250%	35dB
> 250%	$43 + 10 \log P$



Product Service

2.9 OCCUPIED BANDWIDTH

2.9.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049
RSS-170, Clause Annex B: B2

2.9.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018258

2.9.3 Date of Test and Modification State

05 May 2010 - 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 EUT was connected to a Spectrum Analyser via a cable and a 20dB attenuator. The ETU was configured to transmit on bottom, middle and top channels with GMSK modulation. The trace was set to max hold until a sufficient number of sweeps were observed. The 99% occupied bandwidth function was selected on the spectrum analyser and the result and the trace were recorded.

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 1

2.9.6 Environmental Conditions

	05 May 2010
Ambient Temperature	23°C
Relative Humidity	32%



Product Service

2.9.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 2 and RSS-170 for Occupied Bandwidth.

The test results are shown below.

Configuration 1 - Mode 1

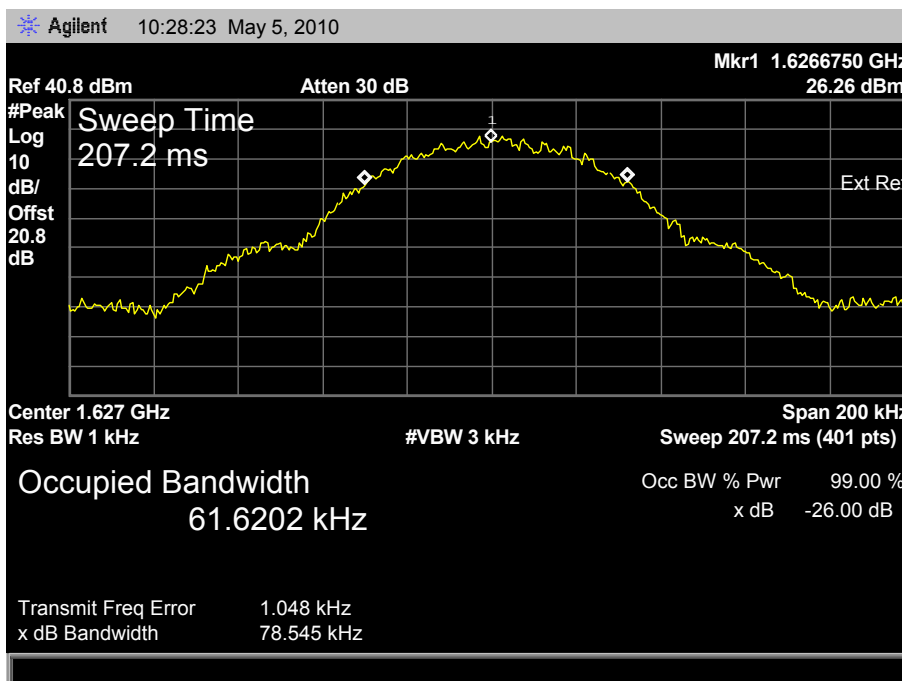
3.7 V DC Supply

Frequency (MHz)	Results (kHz)
1626.675	61.6202
1646.675	61.5907
1660.475	61.7432

Limit Clause

FCC declared authorised bandwidth: 70kHz

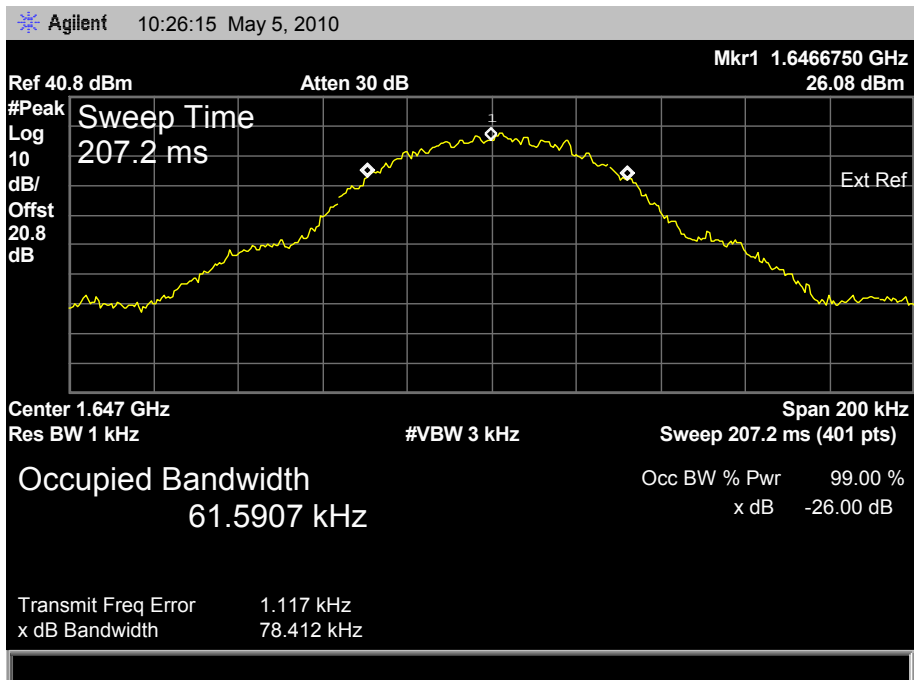
1626.675



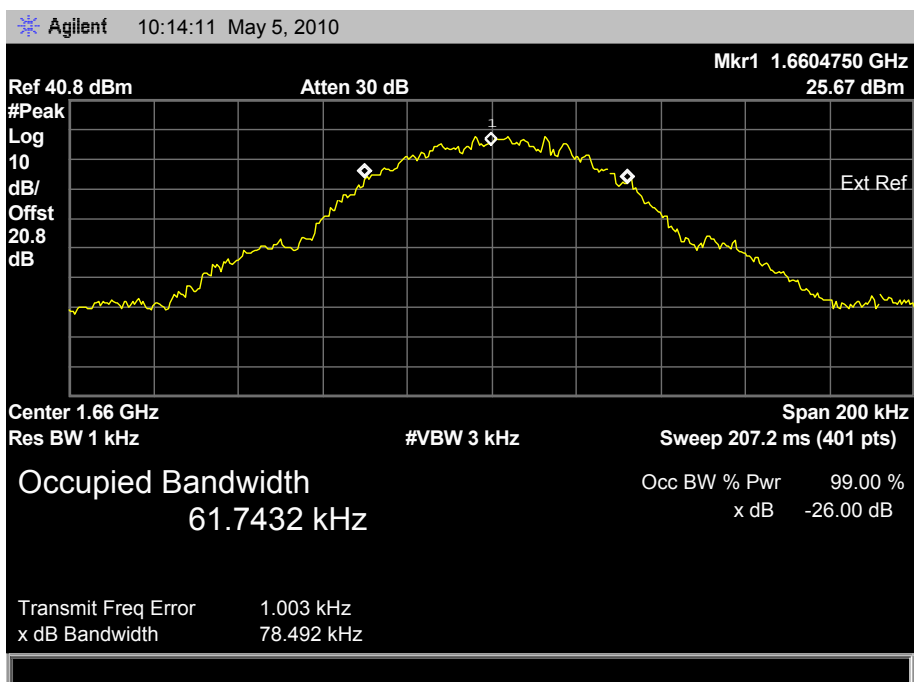


Product Service

1646.675



1660.475





Product Service

2.10 FREQUENCY TOLERANCE / FREQUENCY STABILITY

2.10.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055
 FCC CFR 47 Part 25, Clause 25.202(d)
 RSS-170, Clause Annex B: B5

2.10.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018258

2.10.3 Date of Test and Modification State

28 and 29 April 2010 - Modification State 0

2.10.4 Test Equipment Used

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

2.10.5 Test Method and Operating Modes

The EUT was connected to an FSQ spectrum analyser via a cable and 30 dB attenuator. The EUT was configured to transmit a modulated carrier at maximum power using customer supplied test scripts.

The trace was set to max hold until a sufficient number of sweeps was observed. Measurements were made over 145.75 symbols. The VSA function was selected on the Spectrum Analyser and the result and the trace were recorded.

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

Configuration 1 - Mode 1

2.10.6 Environmental Conditions

	28 and 29 April 2010
Ambient Temperature	23°C
Relative Humidity	47%



Product Service

2.10.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 25 and RSS-170 for Power and Antenna Height Limits.

The test results are shown below.

Configuration 1 - Mode 1

3.7 V DC Supply

Temperature	1626.675MHz		1643.675MHz		1660.475MHz	
	Error Hz	ppm	Error Hz	ppm	Error Hz	ppm
-30	-171	-0.10	-116	-0.07	-91	-0.05
-20	167	0.10	163	0.09	149	0.08
-10	-216	-0.13	-209	-0.12	-207	-0.12
0	-478	-0.29	-501	-0.30	-520	-0.31
10	38	0.02	42	0.02	57	0.03
20 @ V _{nom}	275	0.16	-7.50	-0.004	268	0.16
20 @ V _{min}	362	0.22	7.80	0.004	341	0.20
20 @ V _{max}	727	0.44	757	0.46	46	0.46
30	659	0.41	654	0.39	650	0.39
40	945	0.58	969	0.58	1000	0.60
50	1280	0.78	1290	0.78	1300	0.78

Limit Clause

25.202(d) for FCC

Maximum Frequency Error	±320Hz
-------------------------	--------

Annex B:B5 RSS-170

Maximum Frequency Error	±0.001% of reference frequency
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Product Service

2.11 POWER AND ANTENNA HEIGHT LIMITS

2.11.1 Specification Reference

FCC CFR 47 Part 25, Clause 25.204 / 2.1046
RSS-170, Clause 6.2

2.11.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018258

2.11.3 Date of Test and Modification State

06 May 2010 - Modification State 0

2.11.4 Test Equipment Used

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

2.11.5 Test Method and Operating Modes

The EUT was connected to a power meter via a cable and 30dB attenuator. The path loss was measured and entered as a reference level offset into the instrumentation. The transmit power was measured over the whole burst due to its length being less than 100ms. The average power was measured with modulation on bottom and top channels.

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

Configuration 1 - Mode 1

2.11.6 Environmental Conditions

	06 May 2010
Ambient Temperature	23°C
Relative Humidity	33%



Product Service

2.11.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 25 and RSS-170 for Carrier Power.

The test results are shown below.

Configuration 1 - Mode 1

3.7 V DC Supply

Frequency (MHz)	Measured Conducted Power (dBm)	Measured Conducted Power (W)
1626.675	34.07	2.55
1660.475	34.22	2.64
1646.675	33.83	2.42

Limit Clause

25.202(f) / 25.216 for FCC and 6.3 for RSS-170

Necessary EIRP = 7dBw = 37dBm = 5.01W (as declared by manufacturer)

Conducted Limit = Max Permissible EIRP -2dB = 37dBm



2.12 MODULATION CHARACTERISTICS

2.12.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1046

2.12.2 Equipment Under Test

IsatPhone Pro GMR2+ Satellite Phone, IMEI: 004401510018258

2.12.3 Date of Test and Modification State

06 May 2010 - Modification State 0

2.12.4 Test Equipment Used

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

2.12.5 Test Method and Operating Modes

Description of Modulation Technique

The modulation scheme used in GMR2+ 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 GMR2+ 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 = 67.708 kbit/s / 50 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

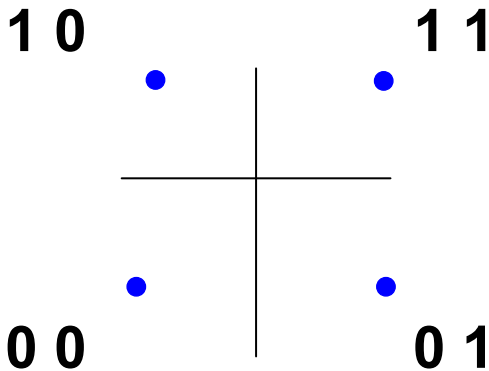
The modulation scheme used for the EUT is GMSK.

A brief overview of how GMSK works is shown on the following page.



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	0 1
PHASE	225°	45°	135°	315°

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 $\pm 90^\circ$

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 $\pi/2$, 0 = -90° or $-\pi/2$ phase shift)

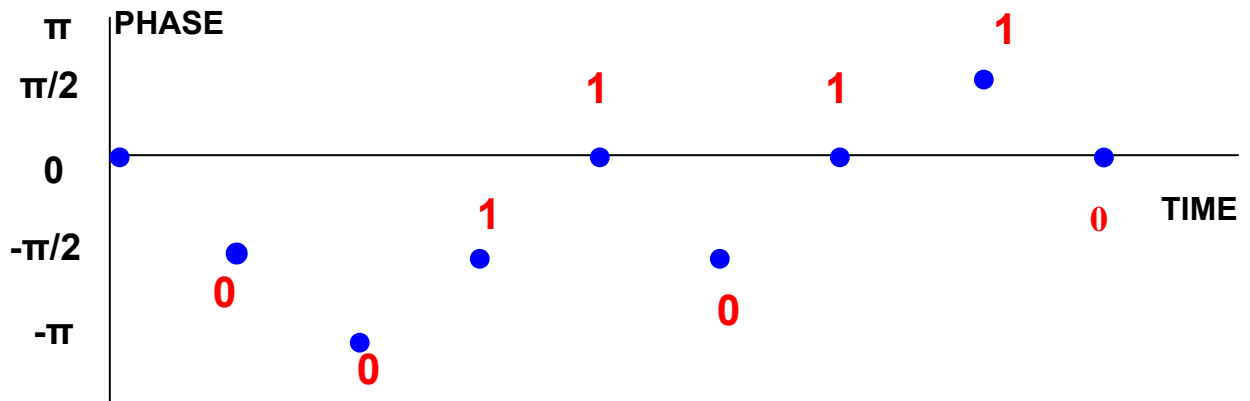
I Stream	0		1		0		1	
	$-\pi/2$		$-\pi/2$		$-\pi/2$		$\pi/2$	
Q stream		0		1		1		0
		$-\pi/2$		$\pi/2$		$\pi/2$		$-\pi/2$

3. Combine (add) the two PSK signals:

Combined Phase	$-\pi/2$	$-\pi$	$-\pi/2$	0	$-\pi/2$	0	$\pi/2$	0
----------------	----------	--------	----------	---	----------	---	---------	---

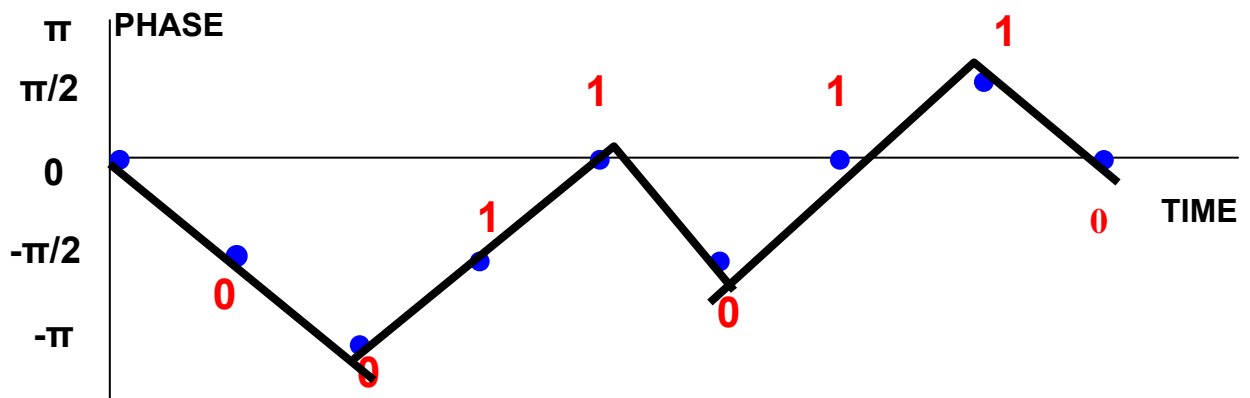


Result: offset - QPSK, phase change is restricted to $\pm \pi/2$ radians:



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.

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

Configuration 1 - Mode 1

2.12.6 Environmental Conditions

06 May 2010
 Ambient Temperature 23°C
 Relative Humidity 34%



Product Service

2.12.7 Test Results

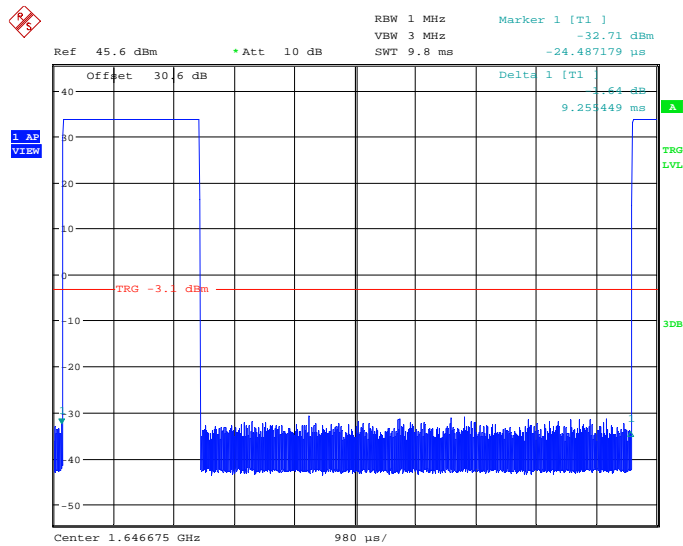
For the period of test the EUT met the requirements of FCC CFR 47 Part 2 for Modulation Characteristics.

The test results are shown below.

Configuration 1 - Mode 1

3.7 V DC Supply

Plot 1

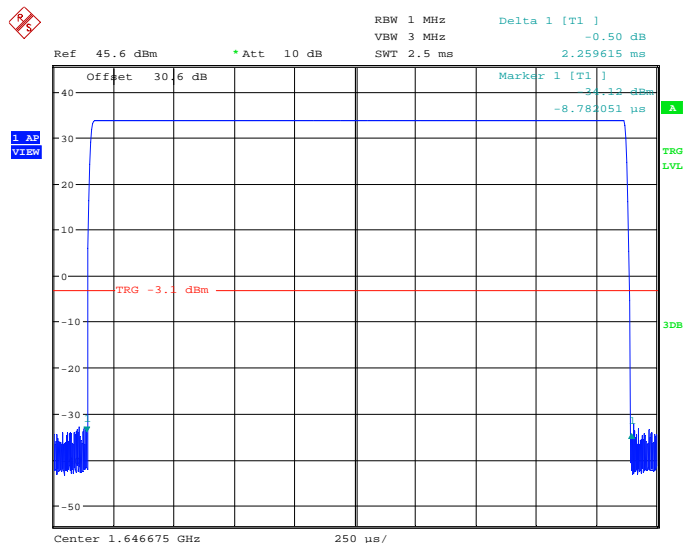


OBW1
Date: 6.MAY.2010 14:15:57



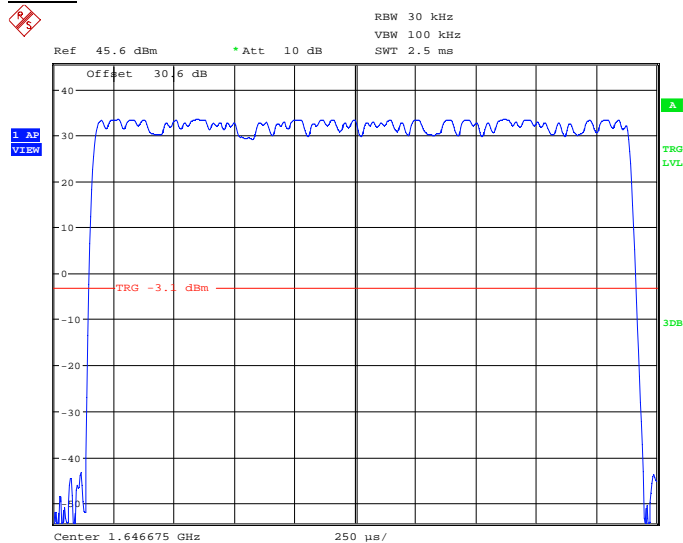
Product Service

Plot 2



OBW1
Date: 6.MAY.2010 14:14:52

Plot 3

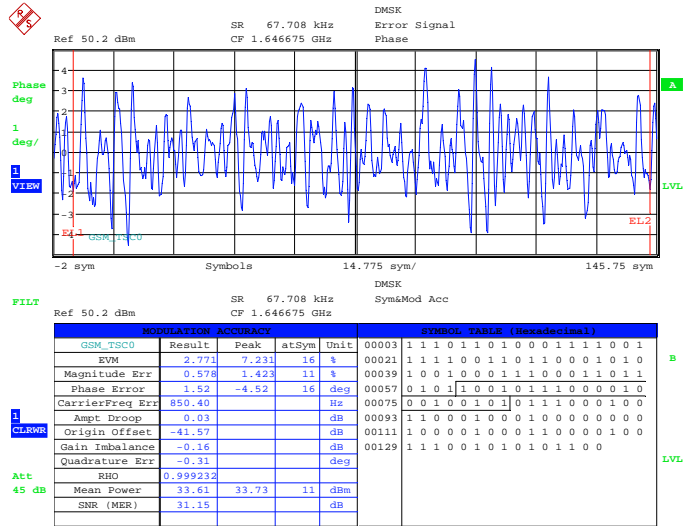


OBW1
Date: 6.MAY.2010 14:13:43



Product Service

Plot 4



OBW1
Date: 6.MAY.2010 14:28:11



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 and 2.2 - Spurious Emissions and EIRP Peak Power					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	12-Oct-2010
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	12-Oct-2010
Dual Power Supply Unit	Thurlby	PL320	288	-	TU
Antenna (Double Ridge Guide)	Q-Par Angus Ltd	QSH 180K	1511	24	17-Jul-2010
Pre-Amplifier	Phase One	PS04-0085	1532	12	16-Sep-2010
Pre-Amplifier	Phase One	PS04-0086	1533	12	17-Sep-2010
Pre-Amplifier	Phase One	PSO4-0087	1534	12	22-Sep-2010
Screened Room (5)	Rainford	Rainford	1545	36	11-Feb-2011
Mast Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Turntable/Mast Controller	EMCO	2090	1607	-	TU
Turntable/Mast Controller	EMCO	2090	1610	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	4-Dec-2011
Comb Generator	Schaffner	RSG1000	3034	-	TU
GPS/SBAS Simulator	Spirent	STR4500	3056	-	TU
Antenna (DRG Horn)	ETS-LINDGREN	3115	3125	12	26-Apr-2011
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	4-Aug-2010
Compliance 3 Emissions	Schaffner	C3e Software V.4.00.00	3274	-	N/A - Software
High Pass Filter (3GHz)	RLC Electronics	F-100-3000-5-R	3349	12	22-May-2010
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	1-Sep-2010
3 GHz High Pass Filter	K&L uwave	11SH10-3000/X18000-O/O	3552	12	14-Apr-2011



Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.3 and 2.6 - Spurious Emissions (Conducted) and Spurious Emissions					
True RMS Multimeter	Fluke	79 Series III	411	12	24-Jul-2010
Tuneable Notch Filter	K&L uwave	5TNF-1500/3000-N/N	435	-	TU
Attenuator (10dB)	Weinschel	47-10-34	481	12	26-Mar-2011
Power Divider	Weinschel	1506A	603	12	18-Mar-2011
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	19-Jun-2010
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	8-Sep-2010
800MHz Low Pass Filter	Mini-Circuits	NLP-800	1638	12	TU
Cable (1m, sma(m) - sma(m))	Reynolds	262-0248-1000	2406	12	15-Oct-2010
Multimeter	Iso-tech	IDM101	2421	12	26-Oct-2010
Programmable Power Supply	Iso-tech	IPS 2010	2436	-	O/P Mon
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	2-Nov-2010
Power Supply Unit	Weir	460	2754	-	TU
High Pass Filter (4GHz)	RLC Electronics	F-100-4000-5-R	2773	12	8-Sep-2010
Filter (Hi Pass)	Lorch	5HP7-2500-SR	2779	12	TU
Attenuator (3dB)	Suhner	6803.17.B	3026	12	26-Mar-2011
Attenuator (20dB, 20W)	Weinschel	1	3032	12	10-Jul-2010
Beacon RF Unit	TUV	N/A	3066	-	TU
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3161	12	4-Jun-2010
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	28-Nov-2010
Hygrometer	Rotronic	I-1000	3220	12	27-Apr-2011
Attenuator (20dB, 150W)	Narda	769-20	3367	12	19-May-2010
Attenuator (30dB, 150W)	Narda	769-30	3369	12	19-May-2010
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	3-Jun-2010
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	25-Feb-2011
Logic Level Shifter	Andy Blagg	0V to 10V to TTL Interface	3584	-	O/P Mon
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	26-Jan-2011
Section 2.4 - Spurious Emissions (Conducted)					
Attenuator	Weinschel	46-10-43	400	12	06-May-2011
Detector	ASL (TUV)	RAB1	479	-	TU
Power Splitter	Weinschel	1506A	607	-	TU
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	8-Sep-2010
Cable (1m, sma(m) - sma(m))	Reynolds	262-0248-1000	2406	12	15-Oct-2010
Power Supply	Iso-tech	IPS 2010	2437	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	27-Apr-2011
Attenuator (20dB, 150W)	Narda	769-20	3367	12	O/P Mon
Meter	Fluke	73	3460	12	23-Oct-2010
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	3-Jun-2010
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	25-Feb-2011
Logic Level Shifter	Andy Blagg	0V to 10V to TTL Interface	3584	-	O/P Mon



Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.5 - Spurious Emissions (Conducted)					
Attenuator	Weinschel	46-10-43	400	12	06-May-2011
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	8-Sep-2010
Cable (1m, sma(m) - sma(m))	Reynolds	262-0248-1000	2406	12	15-Oct-2010
Power Supply	Iso-tech	IPS 2010	2437	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	27-Apr-2011
Meter	Fluke	73	3460	12	23-Oct-2010
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	3-Jun-2010
Section 2.7 and 2.8 - Emission Mask					
Antenna (Double Ridge Guide)	EMCO	3115	34	12	18-Jul-2010
Spectrum Analyser	Rohde & Schwarz	FSEM	37	12	21-Apr-2011
Attenuator: 6dB/10W	Trilithic	HFP-50N	476	12	22-Jul-2010
Power Divider	Weinschel	1506A	603	12	18-Mar-2011
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	8-Sep-2010
Hygrometer	Rotronic	A1	1388	12	6-Jul-2010
Screened Room (8)	Rainford	Rainford	1548	-	TU
Multimeter	Iso-tech	IDM101	2421	12	26-Oct-2010
Programmable Power Supply	Iso-tech	IPS 2010	2436	-	O/P Mon
Power Supply Unit	Weir	460	2754	-	TU
Hygrometer	Rotronic	I-1000	2882	12	6-Jul-2010
Cable (1m, sma Type)	Rosenberger	FA210A1010003050	2907	12	21-May-2010
Beacon RF Unit	TUV	N/A	3066	-	TU
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-03-34	3161	12	4-Jun-2010
Hygrometer	Rotronic	I-1000	3220	12	27-Apr-2011
Attenuator (20dB, 150W)	Narda	769-20	3367	12	O/P Mon
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jun-2010
Logic Level Shifter	Andy Blagg	0V to 10V to TTL Interface	3584	-	O/P Mon
Section 2.10 - Frequency Tolerance / Frequency Stability					
Temperature Chamber	Montford	2F3	467	-	O/P Mon
Multimeter	Iso-tech	IDM101	2421	12	26-Oct-2010
Programmable Power Supply	Iso-tech	IPS 2010	2436	-	O/P Mon
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	28-Nov-2010
Thermocouple Thermometer	Fluke	51	3173	12	3-Jul-2010
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-May-2010



Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.11 - Power and Antenna Height Limits					
Peak Power Analyser	Hewlett Packard	8990A	107	12	10-Feb-2011
Temperature Chamber	Montford	2F3	467	-	O/P Mon
Broadband Resistive Power Divider	Weinschel	1506A	605	12	8-Sep-2010
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	8-Sep-2010
Cable (1m, sma(m) - sma(m))	Reynolds	262-0248-1000	2406	12	15-Oct-2010
Multimeter	Iso-tech	IDM101	2421	12	26-Oct-2010
Programmable Power Supply	Iso-tech	IPS 2010	2436	-	O/P Mon
Power Sensor	Hewlett Packard	84812A	2743	-	TU
Attenuator (20dB, 20W)	Weinschel	1	3032	12	10-Jul-2010
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	28-Nov-2010
Thermocouple Thermometer	Fluke	51	3172	12	3-Jul-2010
Hygrometer	Rotronic	I-1000	3220	12	27-Apr-2011
Power Meter	Rohde & Schwarz	NRP	3491	-	TU
Wideband Power Sensor, 50MHz - 18GHz	Rohde & Schwarz	NRP-Z51	3492	12	15-Apr-2011
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	25-Feb-2011
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	26-Jan-2011
Section 2.12 - Modulation Characteristics					
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	8-Sep-2010
Multimeter	Iso-tech	IDM101	2421	12	26-Oct-2010
Programmable Power Supply	Iso-tech	IPS 2010	2436	-	O/P Mon
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	28-Nov-2010
Hygrometer	Rotronic	I-1000	3220	12	27-Apr-2011
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	3-Jun-2010
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	25-Feb-2011
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	26-Jan-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
Frequency Tolerance	Not Applicable	± 11Hz
Maximum Output Power	Not Applicable	±0.5dB

Worst case error for both Time and Frequency measurement 12 parts in 10⁶.

- * In accordance with CISPR 16-4-2
- † In accordance with UKAS Lab 34
- In accordance with EN 61000-4-6



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.

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Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
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