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Report On

FCC Testing of the Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3, B17, B26) & AXGP (TDD41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS
In accordance with FCC CFR 47 Part 15C (ANT+)

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FCC ID: APYHRO00214

Document 75928148 Report 16 Issue 1

December 2014



Product Service

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COMMERCIAL-IN-CONFIDENCE

REPORT ON

FCC Testing of the
Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3,
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In accordance with FCC CFR 47 Part 15C (ANT+)

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PREPARED FOR

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DATED

23 December 2014

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);

J Tuckwell

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SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3, B17, B26) & AXGP
(TDD41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS
In accordance with FCC CFR 47 Part 15C (ANT+)



1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC Testing of the Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3, B17, B26) & AXGP (TDD41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (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)	SHV31
Serial Number(s)	IMEI 004401115315653
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 15C (2013)
Disposal	Held Pending Disposal
Reference Number	Not Applicable
Date	Not Applicable
Order Number	10329
Date	20 October 2014
Start of Test	13 November 2014
Finish of Test	13 December 2014
Name of Engineer(s)	J Tuckwell
Related Document(s)	ANSI C63.10: 2009



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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
ANT+				
2.1	15.207	AC Line Conducted Emissions	Pass	
2.2	15.249 (a) and 15.35 (b)	Field Strength of Fundamental	Pass	
2.3	15.249 (a)(d)	Field Strength of Spurious Emissions	Pass	



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1.3 PRODUCT TECHNICAL DESCRIPTION

Please refer to the SHV31 Model Description Form.

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3, B17, B26) & AXGP (TDD41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS. A full technical description can be found in the manufacturer's documentation.

1.5 TEST CONDITIONS

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

The EUT was powered from a 4.0 V DC supply.

FCC Measurement Facility Registration Number
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard were made during testing.

1.7 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.



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SECTION 2

TEST DETAILS

FCC Testing of the
Sharp SHV31 Dual-band UMTS (FDDI, FDDV) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Quad-band LTE (B1,B3, B17, B26) & AXGP
(TDD41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS
In accordance with FCC CFR 47 Part 15C (ANT+)



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

SHV31 S/N: IMEI 004401115315653 - Modification State 0

2.1.3 Date of Test

13 December 2014

2.1.4 Test Equipment Used

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

2.1.5 Test Procedure

A test environment and testing arrangement meeting the specification of ANSI C63.4 was used during all testing. The Equipment Under Test (EUT) was set upon a non-conducting platform at an elevation of 80 cm above a horizontal reference ground plane. A vertical reference ground plane was situated 40 cm from the EUT and bonded to the horizontal reference ground plane.

The EUT was powered by a Line Impedance Stabilization Network (LISN), whereby emissions measurements of the current-carrying conductors were made through this LISN. The LISN was bonded to the horizontal reference ground plane with a separation distance greater than 80 cm from the EUT. A mains supply cable of 1 m length was used to supply mains power to the EUT from the LISN.

A preliminary emissions scan was conducted for each current-carrying conductor of the EUT, using a peak detector over a frequency range of 150 kHz to 30 MHz. At least six of the greatest peak emissions, frequency positions were selected from each preliminary emissions scan for further evaluation as final measuring points.

Final measurement points were measured using quasi-peak and average detectors. All final measurements were assessed against the emission limits in Clause 15.207 of FCC CFR 47 FCC Part 15.

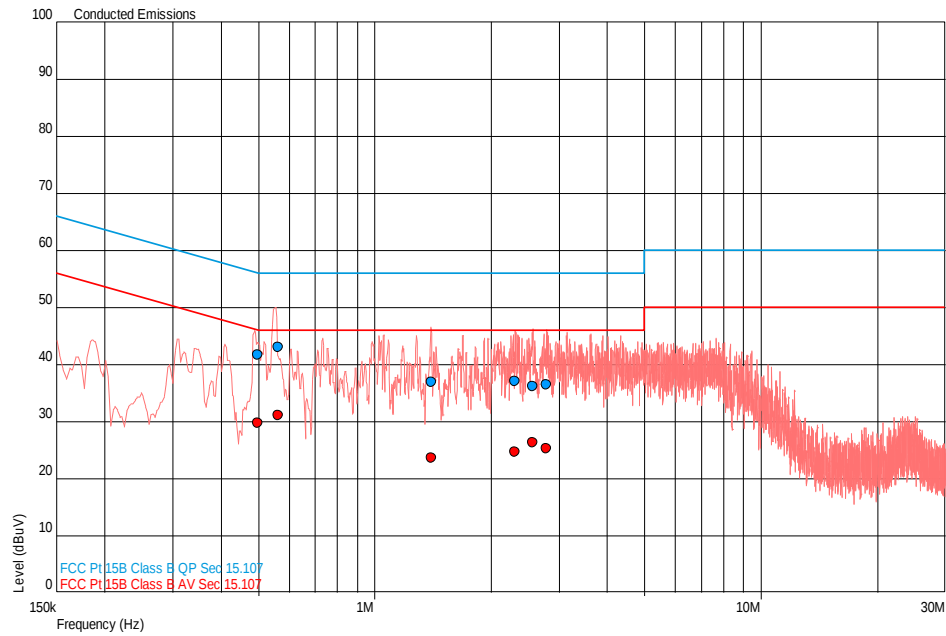
2.1.6 Environmental Conditions

Ambient Temperature	20.5°C
Relative Humidity	26.0%



2.1.7 Test Results

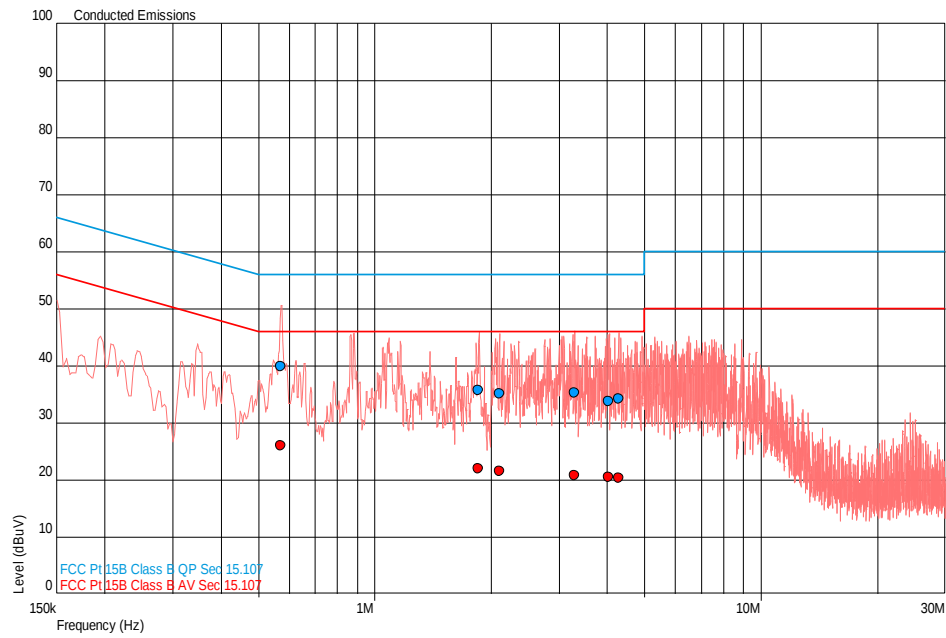
Live Line



Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dBμV)	AV Level (dBμV)	AV Limit (dBμV)	AV Margin (dBμV)
0.499	41.7	56.0	-14.3	29.7	46.0	-16.3
0.563	43.1	56.0	-12.9	31.1	46.0	-14.9
1.399	37.0	56.0	-19.0	23.7	46.0	-22.3
2.309	37.1	56.0	-18.9	24.8	46.0	-21.2
2.567	36.3	56.0	-19.7	26.4	46.0	-19.6
2.777	36.5	56.0	-19.5	25.3	46.0	-20.7



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Neutral Line

Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dBμV)	AV Level (dBμV)	AV Limit (dBμV)	AV Margin (dBμV)
0.572	39.9	56.0	-16.1	26.0	46.0	-20.0
1.858	35.8	56.0	-20.2	22.0	46.0	-24.0
2.103	35.1	56.0	-20.9	21.6	46.0	-24.4
3.295	35.4	56.0	-20.6	20.9	46.0	-25.1
4.039	33.8	56.0	-22.2	20.5	46.0	-25.5
4.284	34.3	56.0	-21.7	20.4	46.0	-25.6



Product Service

2.2 FIELD STRENGTH OF FUNDAMENTAL

2.2.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.249 (a) and 15.35 (b)

2.2.2 Equipment Under Test and Modification State

SHV31 S/N: IMEI 004401115315653 - Modification State 0

2.2.3 Date of Test

5 December 2014

2.2.4 Test Equipment Used

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

2.2.5 Test Procedure

The EUT is placed on a test table 800 mm above the ground plane.

During formal measurement the spectrum analyser is tuned to the frequency of the fundamental. The turntable azimuth is adjusted from 0 to 360 degrees to determine the point at which the maximum level occurs. Then the height of the measuring antenna is adjusted from a height of 1m to 4m to determine the height at which the maximum level occurs. Once the point of maximum emission has been determined the emission is measured.

2.2.6 Environmental Conditions

Ambient Temperature	18.7°C
Relative Humidity	31.0%

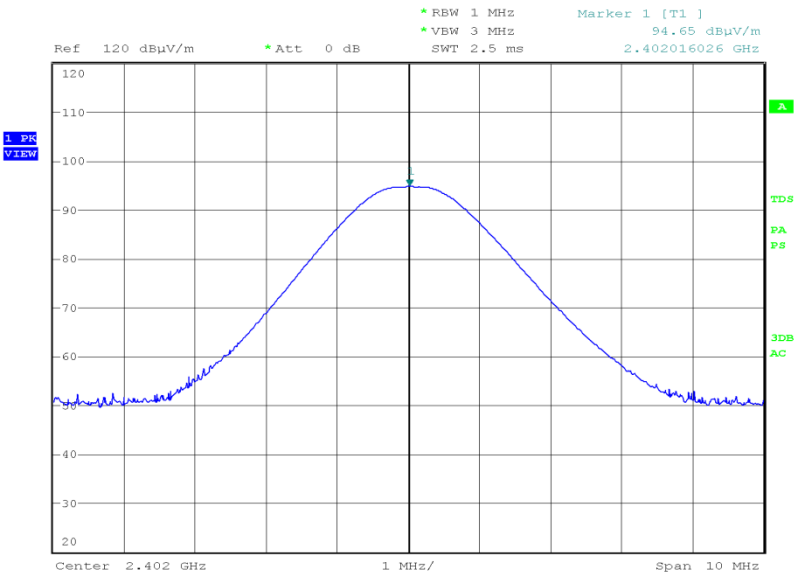


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2.2.7 Test Results

2402 MHz

Fundamental



Date: 5.DEC.2014 14:59:27

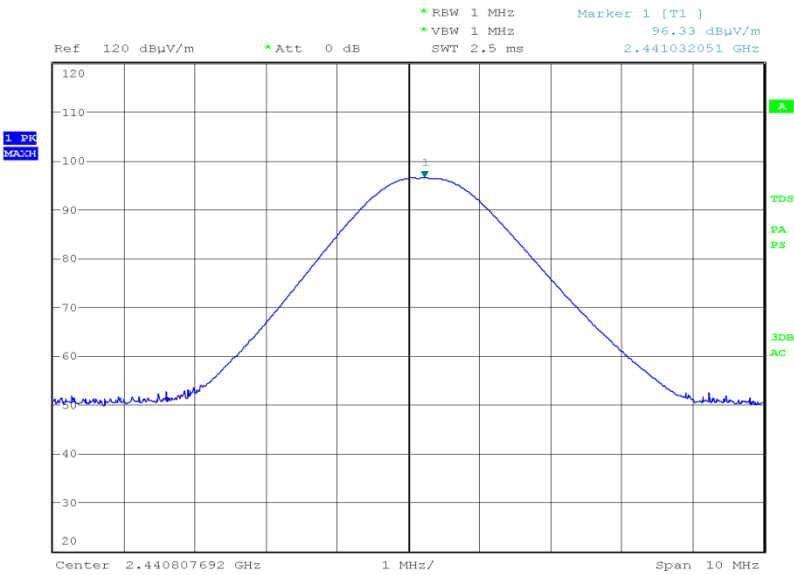
Frequency (MHz)	Result (dBμv/m)	Limit (dBμv/m)
2402	64.672	93.98



Product Service

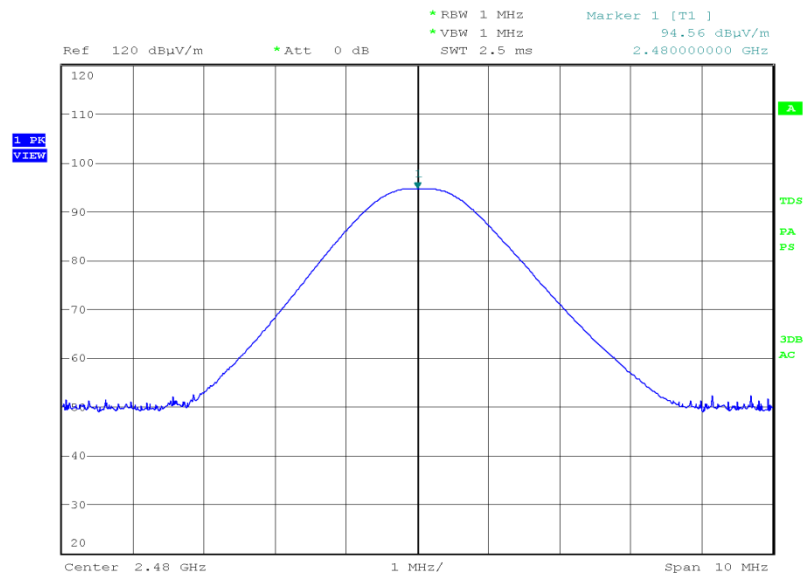
2441 MHz

Fundamental



Date: 5.DEC.2014 15:40:10

Frequency (MHz)	Result (dBμv/m)	Limit (dBμv/m)
2441	64.982	93.98

2480 MHzFundamental

Date: 5.DEC.2014 16:25:29

Frequency (MHz)	Result (dBμV/m)	Limit (dBμV/m)
2480	64.673	93.98

Remark

The duty cycle of the fundamental was measured at 0.13 or 13.39 %. A duty cycle correction was calculated as follows:

$$20 \text{ Log } (0.133922981) = 17.46 \text{ dB}$$

This correction factor was added to the measured average value to obtain a corrected average result shown in the tables.

Limit Clause15.249 (a)

Fundamental Frequency (MHz)	Average Field Strength of Fundamental (millivolts/meter)
2400 to 2483.5	50

15.35 (b)

The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.



2.3 FIELD STRENGTH OF SPURIOUS EMISSIONS

2.3.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.249 (a)(d)

2.3.2 Equipment Under Test and Modification State

SHV31 S/N: IMEI 004401115315653 - Modification State 0

2.3.3 Date of Test

5 December 2014 & 6 December 2014

2.3.4 Test Equipment Used

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

2.3.5 Test Procedure

A preliminary profile of the Spurious Radiated Emissions is obtained up to the 10th harmonic of the EUT's fundamental frequency. For frequencies from 30 MHz to 18 GHz the EUT is placed on a test table 800 mm above the ground plane. For frequencies above 18 GHz, the EUT height is increased by 200 mm to a height of 1000 mm. This is to ensure the beam width of the measuring antenna gives sufficient vertical coverage of the EUT.

During characterisation the turntable azimuth is adjusted from 0 to 360 degrees with the measuring antenna in one polarity. It is then repeated for the other polarity. Any frequencies of interest are noted for formal measuring later. The distance from the measuring antenna to the boundary of the EUT is 3m. Above 18GHz this distance may be reduced to 1m.

During formal measurement the spectrum analyser is tuned to the frequency of the emission. The turntable azimuth is adjusted from 0 to 360 degrees to determine the point at which the maximum emission level occurs. Then the height of the measuring antenna is adjusted from a height of 1m to 4m to determine the height at which the maximum emission level occurs. Once the point of maximum emission has been determined the emission is measured. Emissions in the 30 MHz to 1 GHz range are measured using a CISPR Quasi – Peak detector function in a 120 kHz bandwidth. Emissions in the range 1 GHz to 25 GHz require Peak and Average measurements. The Peak measurements are made using a peak detector with a 1 MHz Resolution bandwidth and a 3 MHz Video bandwidth. The average measurements employ a peak detector with a Resolution bandwidth of 1 MHz and a Video bandwidth of at least 10 Hz. If measurements are made at a 1m measuring distance, then 10 dB is added to the specification limit.

2.3.6 Environmental Conditions

Ambient Temperature	18.0 - 19.5°C
Relative Humidity	27.0 - 31.0%

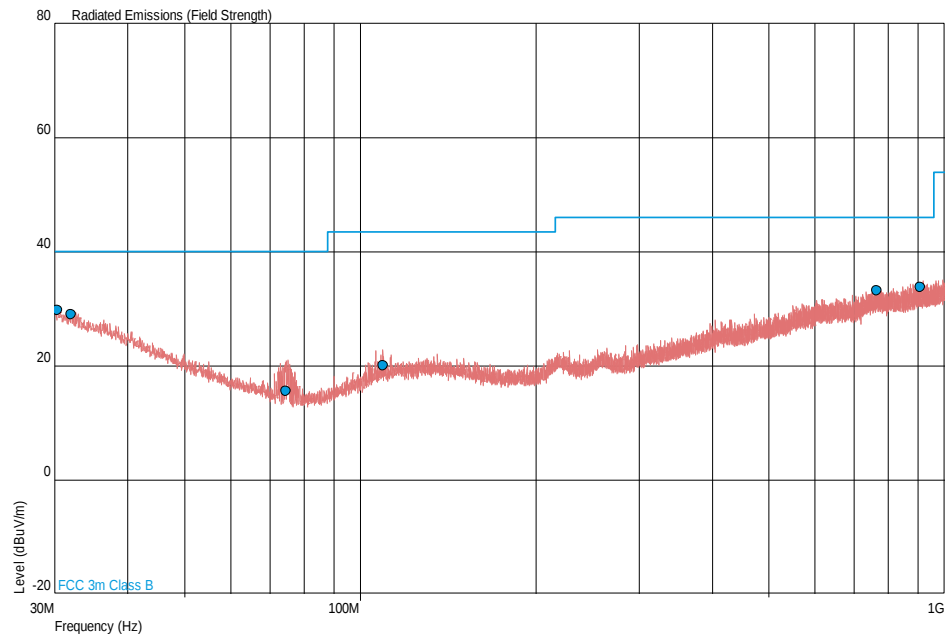


Product Service

2.3.7 Test Results

2402 MHz

30 MHz to 1 GHz

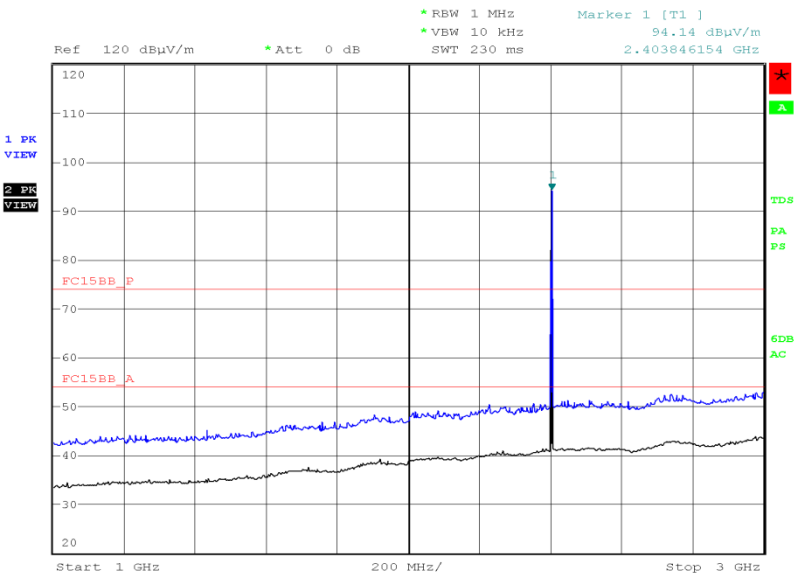


Frequency (MHz)	QP Level (dBuV/m)	QP Level (uV/m)	QP Limit (dBuV/m)	QP Limit (uV/m)	QP Margin (dBuV/m)	QP Margin (uV/m)	Angle (Deg)	Height (m)	Polarity
30.390	29.8	30.9	40.0	100	-10.2	-69.1	222	1.00	Vertical
31.994	29.0	28.2	40.0	100	-11.0	-71.8	183	1.00	Horizontal
74.632	15.6	6.0	40.0	100	-24.4	-94.0	100	1.00	Vertical
109.447	20.1	10.1	43.5	150	-23.4	-139.9	86	1.00	Vertical
765.320	33.2	45.7	46.0	200	-12.8	-154.3	360	3.38	Vertical
908.724	33.8	49.0	46.0	200	-12.2	-151.0	73	3.23	Vertical



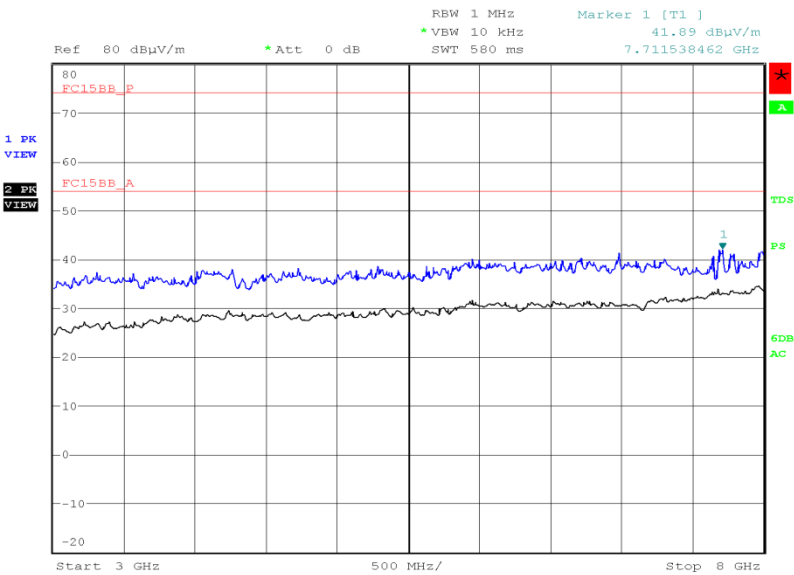
Product Service

1 GHz to 3 GHz



Date: 5.DEC.2014 15:26:09

3 GHz to 8 GHz

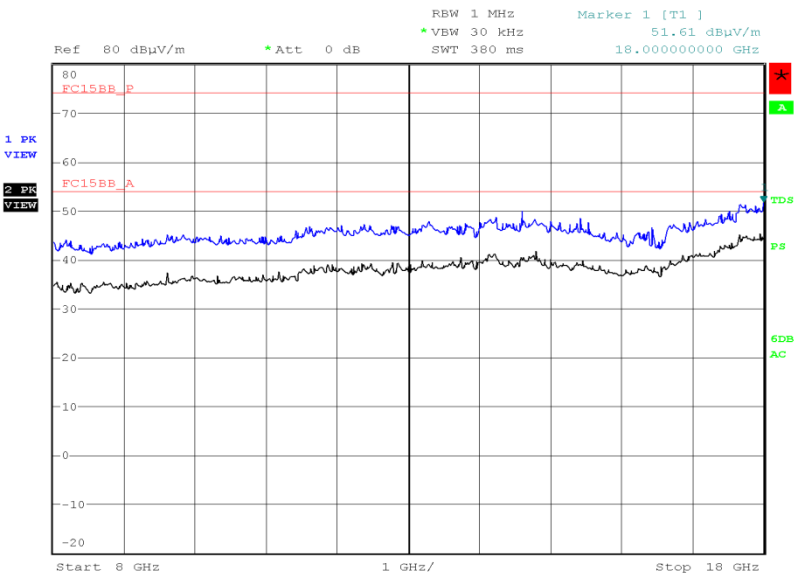


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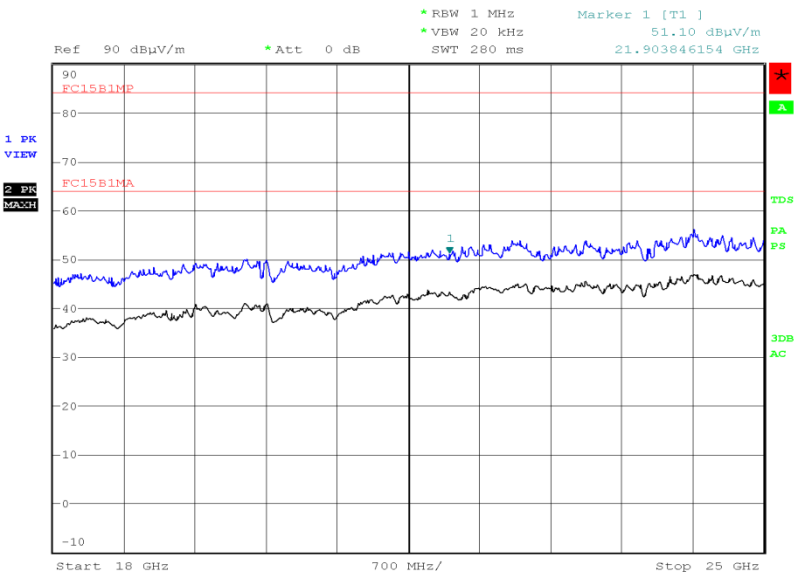
Product Service

8 GHz to 18 GHz

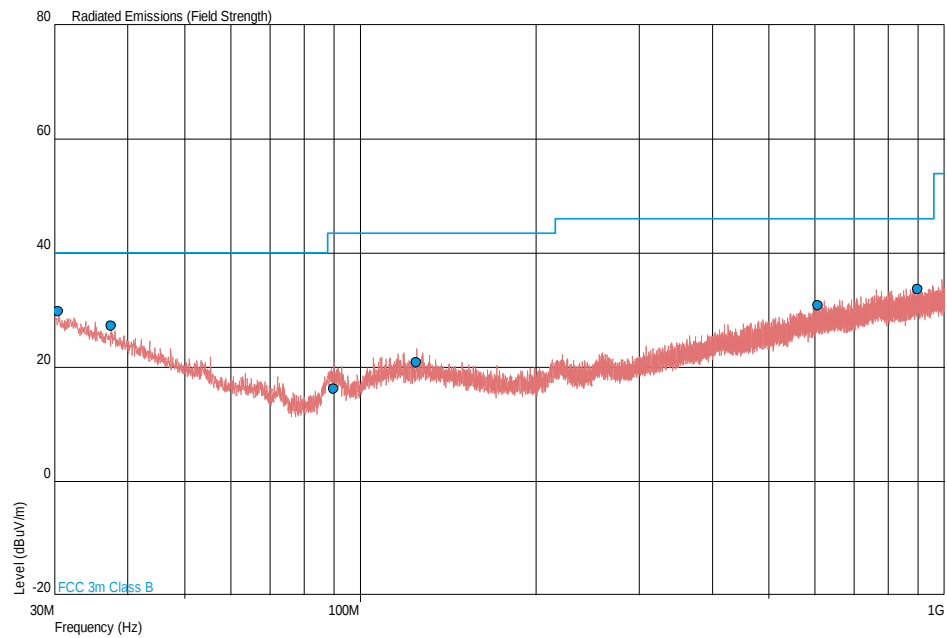


Date: 6.DEC.2014 10:29:51

18 GHz to 25 GHz



Date: 5.DEC.2014 21:42:17

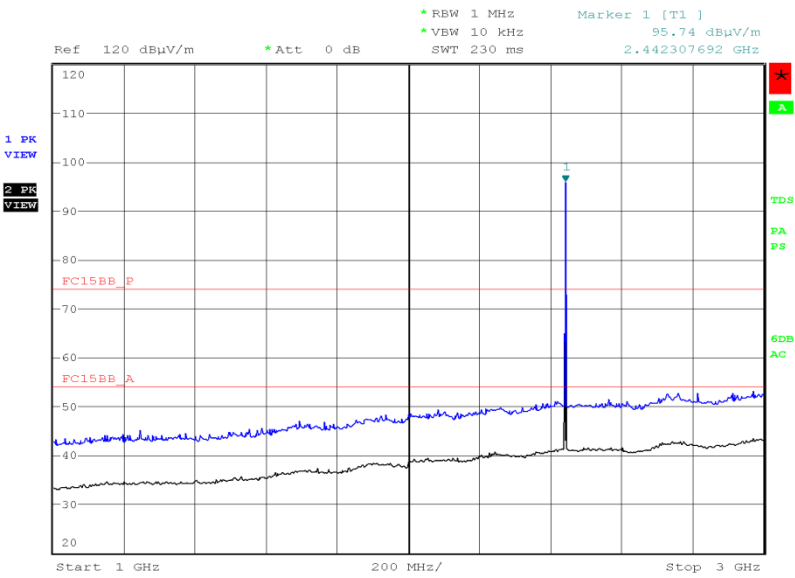
2441 MHz30 MHz to 1 GHz

Frequency (MHz)	QP Level (dBμV/m)	QP Level (μV/m)	QP Limit (dBμV/m)	QP Limit (μV/m)	QP Margin (dBμV/m)	QP Margin (μV/m)	Angle (Deg)	Height (m)	Polarity
30.485	29.7	30.5	40.0	100	-10.3	-69.5	248	2.74	Vertical
37.527	27.2	22.9	40.0	100	-12.8	-77.1	85	1.00	Vertical
90.100	16.3	6.5	43.5	150	-27.2	-143.5	322	1.00	Vertical
124.765	20.9	11.1	43.5	150	-22.6	-138.9	0	1.00	Vertical
607.190	30.8	34.7	46.0	200	-15.2	-165.3	360	3.73	Vertical
899.245	33.7	48.4	46.0	200	-12.3	-151.6	179	1.00	Horizontal



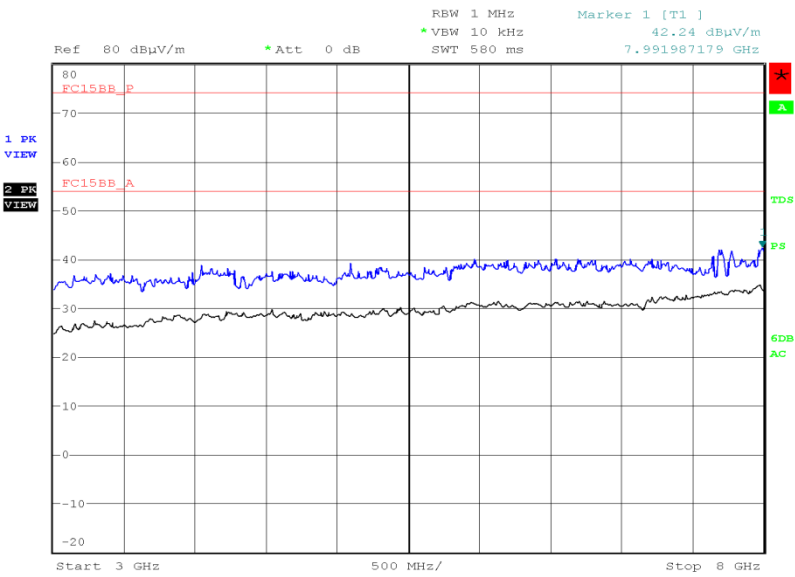
Product Service

1 GHz to 3 GHz



Date: 5.DEC.2014 15:32:47

3 GHz to 8 GHz

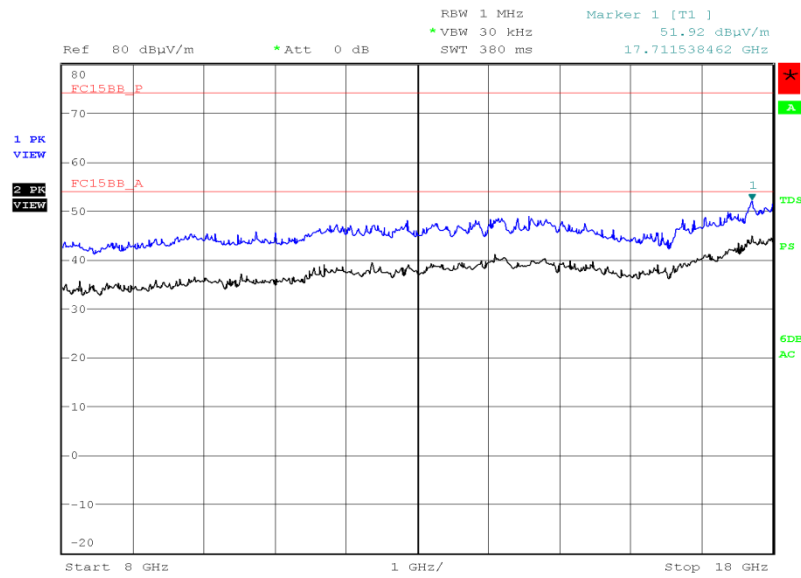


Date: 6.DEC.2014 09:35:46



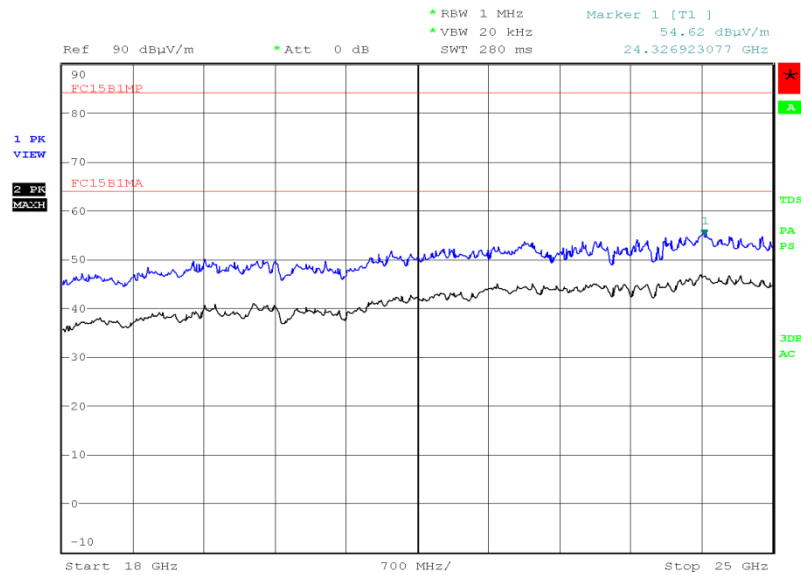
Product Service

8 GHz to 18 GHz

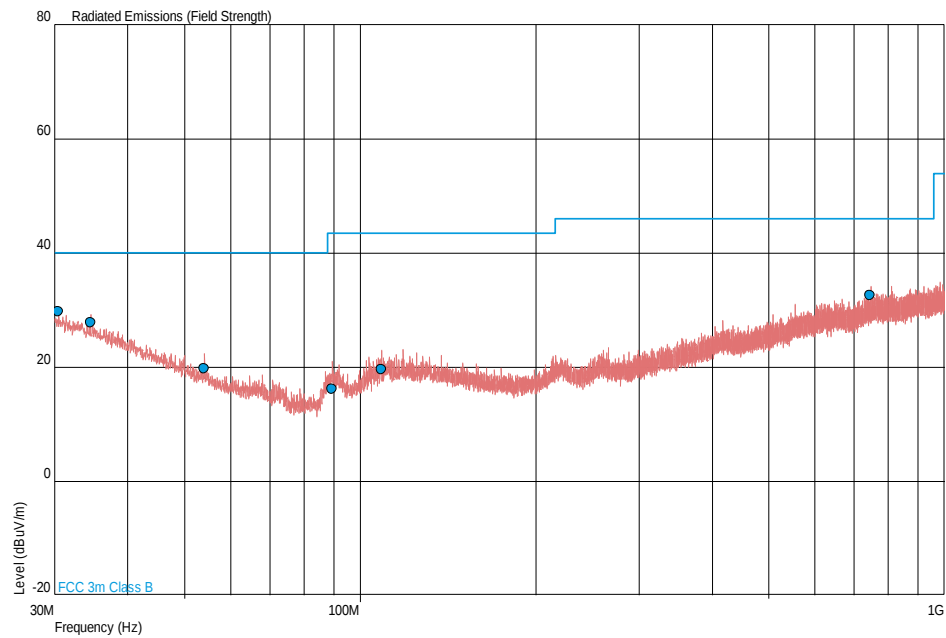


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18 GHz to 25 GHz



Date: 5.DEC.2014 22:28:30

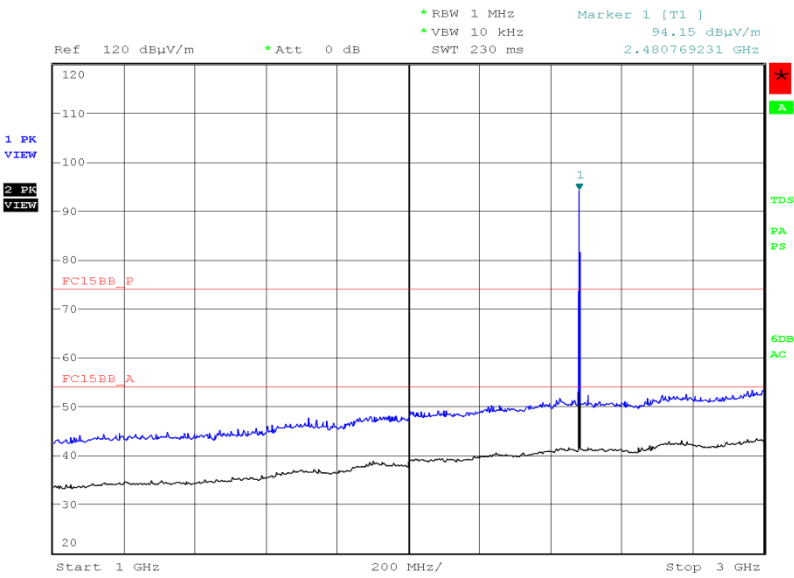
2480 MHz30 MHz to 1 GHz

Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.487	29.7	30.5	40.0	100	-10.3	-69.5	360	4.00	Vertical
34.620	27.8	24.5	40.0	100	-12.2	-75.5	251	2.09	Vertical
54.102	19.8	9.8	40.0	100	-20.2	-90.2	11	1.00	Vertical
89.599	16.2	6.5	43.5	150	-27.3	-143.5	273	3.68	Vertical
108.770	19.6	9.5	43.5	150	-23.9	-140.5	139	1.00	Vertical
745.816	32.6	42.7	46.0	200	-13.4	-157.3	337	3.41	Vertical



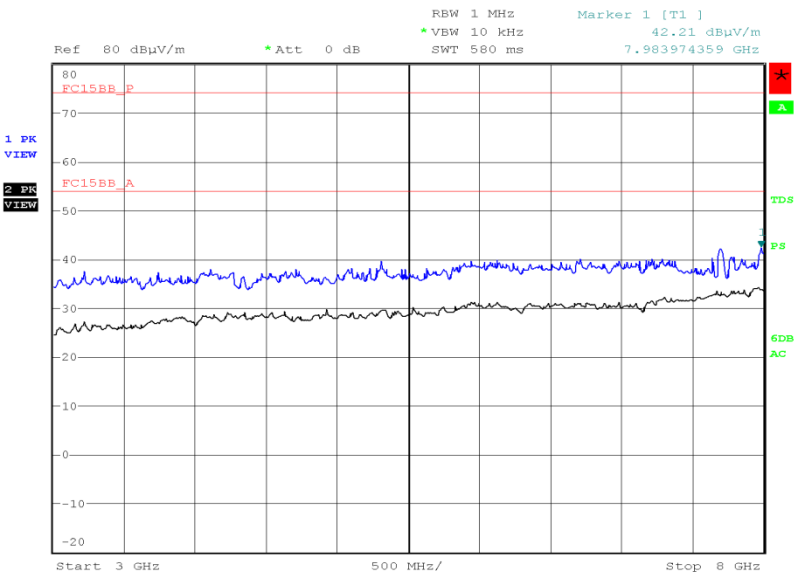
Product Service

1 GHz to 3 GHz



Date: 5.DEC.2014 17:14:20

3 GHz to 8 GHz

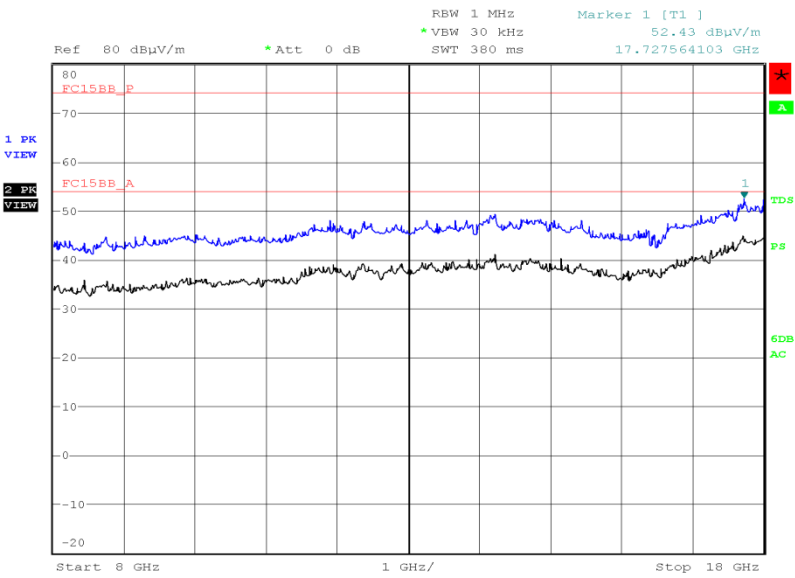


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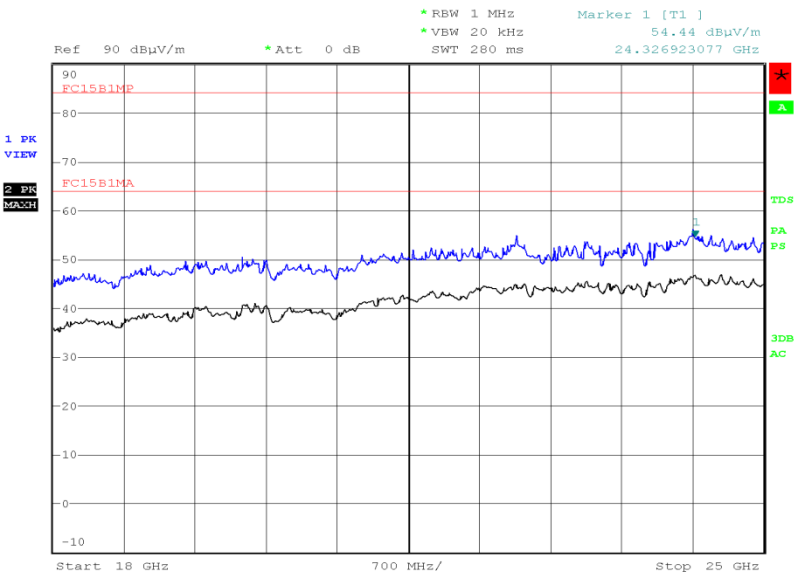
Product Service

8 GHz to 18 GHz



Date: 6.DEC.2014 10:14:10

18 GHz to 25 GHz



Date: 5.DEC.2014 22:32:47



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Limit Clause15.249 (a)

Fundamental Frequency (MHz)	Field Strength of Harmonics (microvolts/meter)
2400 to 2483.5	500

15.249 (d), 15.209

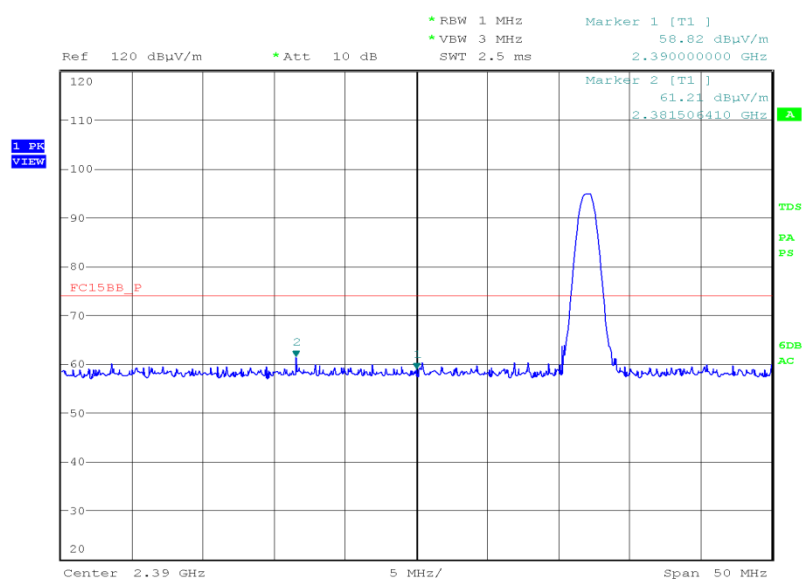
Frequency (MHz)	Field Strength (microvolts/meter)
0.009 to 0.490	2400/F (kHz)
0.490 to 1.705	24000/F (kHz)
1.705 to 30.0	30
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500



Product Service

Band Edge Emissions

Restricted Bands of Operation		
Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)
2390.00	61.21	47.70
2483.50	60.21	47.57

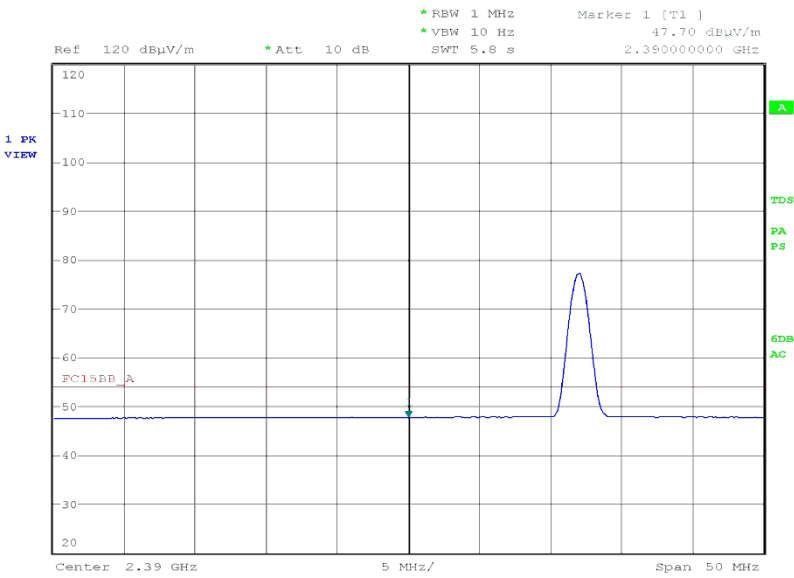
2390.00 MHzFinal Peak

Date: 5.DEC.2014 15:07:59



Product Service

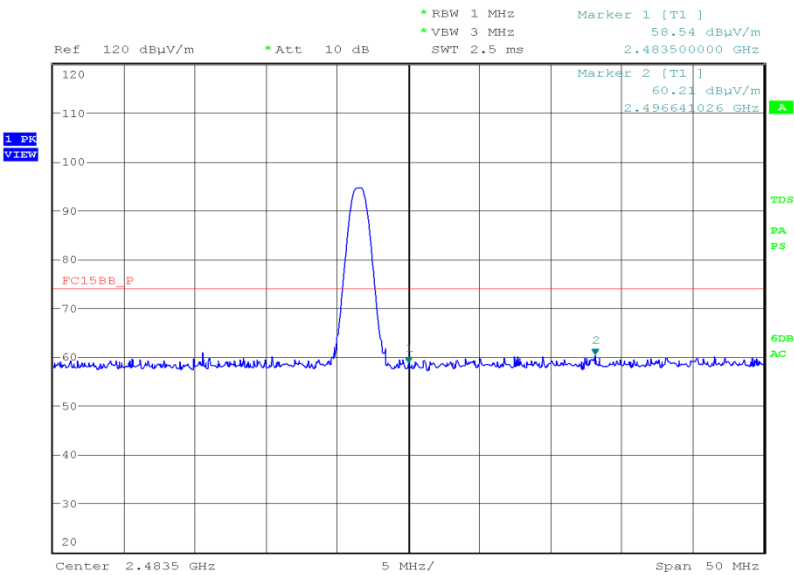
Final Average



Date: 17.DEC.2014 13:59:17

2483.50 MHz

Final Peak



Date: 5.DEC.2014 16:29:48

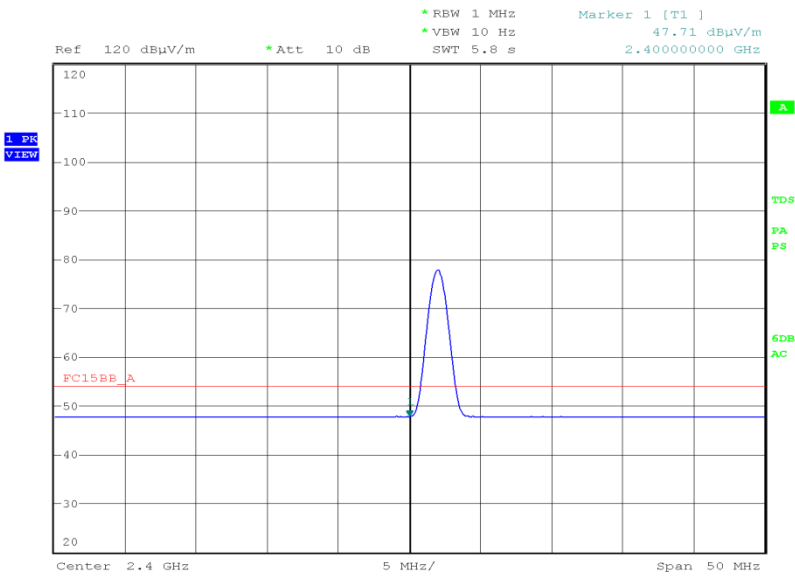


Product Service

Band Edge	
Frequency (MHz)	Final Average (dBμV/m)
2400.00	47.71
2483.50	47.57

2400.00 MHz

Final Average



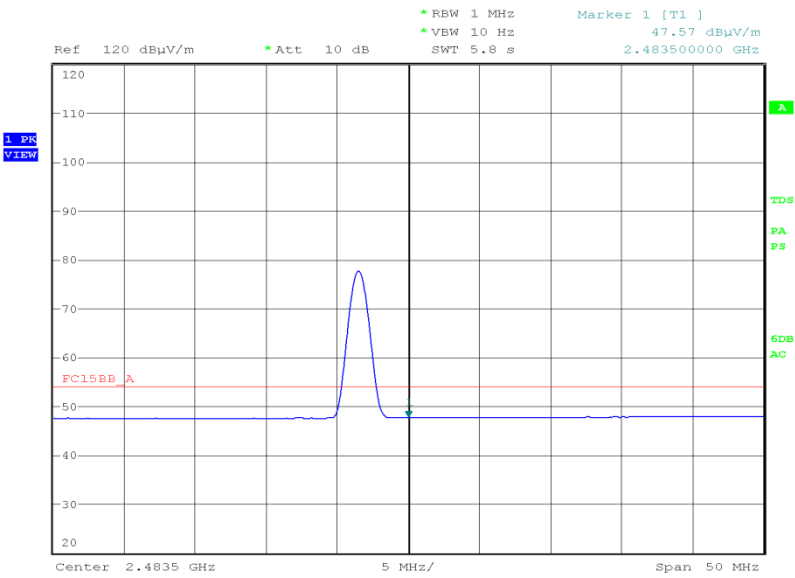
Date: 5.DEC.2014 15:10:02



Product Service

2483.50 MHz

Final Average



Date: 5.DEC.2014 16:30:56

Limit

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



Product Service

SECTION 3

TEST EQUIPMENT USED



Product Service

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 - AC Line Conducted Emissions					
3 phase LISN	Rohde & Schwarz	ESH2-Z5	323	12	16-Jan-2015
Transient Limiter	Hewlett Packard	11947A	2378	12	1-Jul-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
Section 2.2 - Field Strength of Fundamental					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	2-May-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
Tilt Antenna Mast	mature GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	mature GmbH	NCD	3917	-	TU
Section 2.3 - Field Strength of Spurious Emissions					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	2-May-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
Amplifier (8 - 18GHz)	Phase One	PS06-0061	3176	12	11-Aug-2015
Compliance 5 Emissions	Schaffner	C5e Software V.5.00.00	3275	-	N/A - Software
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
Tilt Antenna Mast	mature GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	mature GmbH	NCD	3917	-	TU

TU – Traceability Unscheduled

O/P MON – Output Monitored with Calibrated Equipment



Product Service

3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	MU
AC Line Conducted Emissions	± 3.2 dB
Field Strength of Fundamental	30MHz to 1GHz: ± 5.1 dB 1GHz to 40GHz: ± 6.3 dB
Field Strength of Spurious Emissions	30MHz to 1GHz: ± 5.1 dB 1GHz to 40GHz: ± 6.3 dB



Product Service

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

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