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Report On

FCC Testing of the Sharp SHL25 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDD I, FDD V) & Quad-band LTE (B1, B3, B17, B18) & AXGP (TDD 41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS
In accordance with FCC CFR 47 Part 15C (ANT+)

COMMERCIAL-IN-CONFIDENCE
FCC ID: APYHRO00206

Document 75925936 Report 20 Issue 1 May 2014

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REPORT ON

FCC Testing of the Sharp SHL25 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDD I, FDD V) & Quad-band LTE (B1, B3, B17, B18) & AXGP (TDD 41) multi mode cellular phone with Bluetooth, ANT+, WLAN, SRD (NFC, FeliCa) and GPS
In accordance with FCC CFR 47 Part 15C (ANT+)

Document 75925936 Report 20 Issue 1

May 2014

PREPARED FOR

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Bracknell
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PREPARED BY

Natalie Bennett
Senior Administrator, Technical Solutions

APPROVED BY

Nic Forsyth
Authorised Signatory

DATED 12 May 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);

T Guy G Lawler

Product Service

CONTENTS

Product Service

SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp SHL25 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDD I, FDD V) & Quad-band LTE (B1, B3, B17, B18) & AXGP (TDD 41) 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 SHL25 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDD I, FDD V) & Quad-band LTE (B1, B3, B17, B18) & AXGP (TDD 41) 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)	SHL25
Serial Number(s)	IMEI 004401115170256
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 15C (2013)
Incoming Release Date	Application Form 24 March 2014
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	10070 10 March 2014
Start of Test	07 April 2014
Finish of Test	19 April 2014
Name of Engineer(s)	T Guy G Lawler
Related Document(s)	ANSI C63.10: 2009

Product Service

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)	Field Strength of Fundamental	Pass	
2.3	15.249 (a)(d)	Field Strength of Spurious Emissions	Pass	

1.3 PRODUCT TECHNICAL DESCRIPTION

Please refer to the SHL25 Model Description Form.

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp SHL25 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDD I, FDD V) & Quad-band LTE (B1, B3, B17, B18) & AXGP (TDD 41) 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 3.7 V DC supply.

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

1.6 DEVIATIONS FROM THE STANDARD

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

1.7 MODIFICATION RECORD

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

Product Service

SECTION 2

TEST DETAILS

FCC Testing of the
Sharp SHL25 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDD I, FDD V) & Quad-band LTE (B1, B3, B17, B18) & AXGP (TDD 41) 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

SHL25 S/N: IMEI 004401115170256 - Modification State 0

2.1.3 Date of Test

19 April 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.

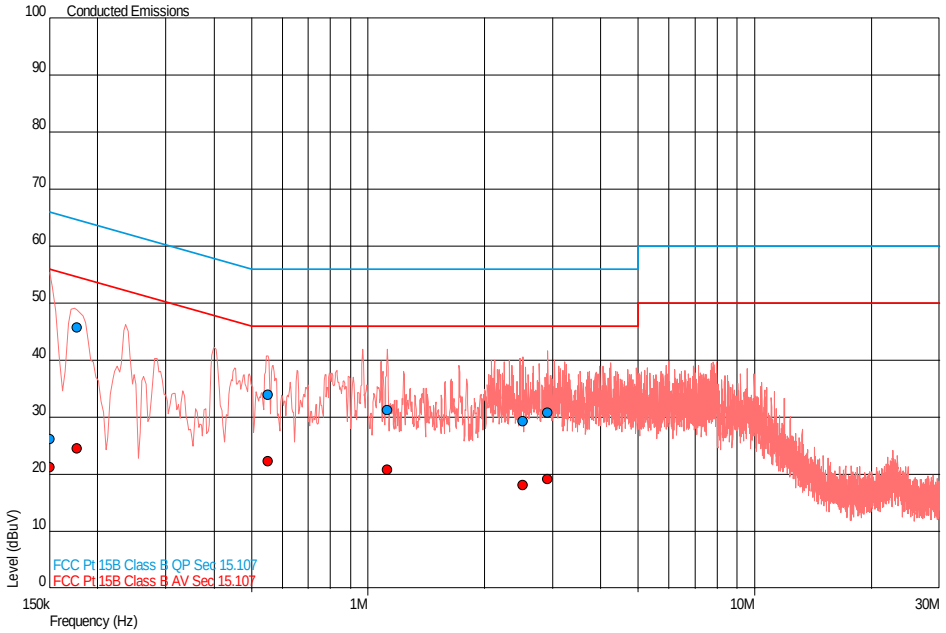
Final measurement points were measured using quasi-peak and average detectors. All final measurements were assessed against the emission limits in Clause 15.207 of FCC CFR 47 FCC Part 15.

2.1.6 Environmental Conditions

Ambient Temperature	19.7°C
Relative Humidity	27.0%

2.1.7 Test Results

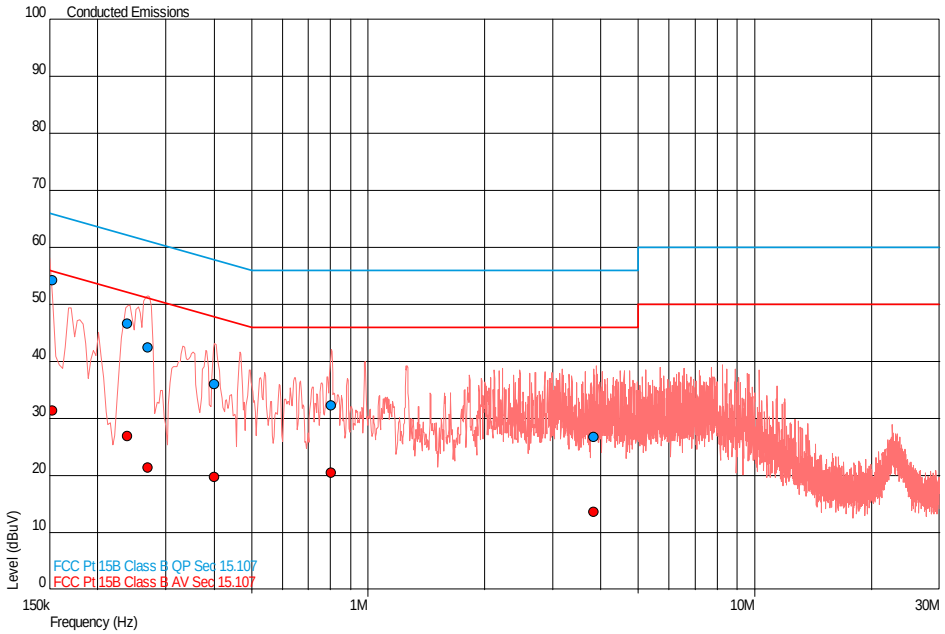
Live Line



Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dBµV)
0.150	26.2	66.0	-39.8	21.2	56.0	-34.8
0.177	45.7	64.6	-18.9	24.6	54.6	-30.0
0.551	34.0	56.0	-22.0	22.3	46.0	-23.7
1.124	31.2	56.0	-24.8	20.8	46.0	-25.2
2.520	29.4	56.0	-26.6	18.2	46.0	-27.8
2.916	30.8	56.0	-25.2	19.2	46.0	-26.8

Product Service

Neutral Line



Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dBµV)
0.153	54.2	65.9	-11.7	31.4	55.9	-24.4
0.239	46.6	62.1	-15.6	26.9	52.1	-25.3
0.270	42.4	61.1	-18.7	21.5	51.1	-29.6
0.400	36.0	57.9	-21.8	19.8	47.9	-28.1
0.805	32.3	56.0	-23.7	20.5	46.0	-25.5
3.831	26.8	56.0	-29.2	13.7	46.0	-32.3

2.2 FIELD STRENGTH OF FUNDAMENTAL

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

SHL25 S/N: IMEI 004401115170256 - Modification State 0

2.2.3 Date of Test

7 April 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

A preliminary profile of the Spurious Radiated Emissions is obtained up to the 10th harmonic of the EUT's fundamental frequency. For frequencies from 30MHz to 18GHz the EUT is placed on a test table 800mm above the ground plane. For frequencies above 18GHz, the EUT height is increased by 200mm to a height of 1000mm. 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 30MHz to 1GHz range are measured using a CISPR Quasi – Peak detector function in a 120kHz bandwidth. Emissions in the range 1GHz to 40GHz require Peak and Average measurements. The Peak measurements are made using a peak detector with 1MHz Resolution and Video bandwidths. The average measurements employ a peak detector with a Resolution bandwidth of 1MHz and a Video bandwidth of 10Hz. If measurements are made at a 1m measuring distance, then 10dB is added to the specification limit.

2.2.6 Environmental Conditions

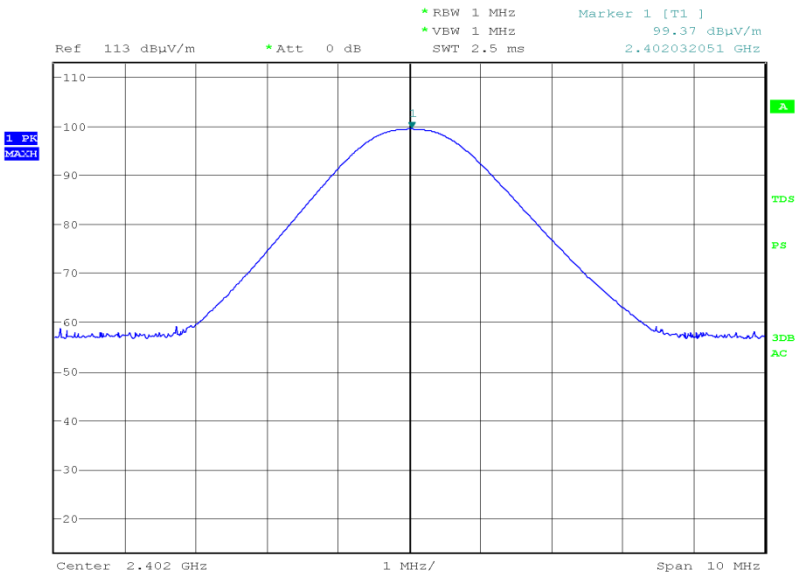
Ambient Temperature	20.9°C
Relative Humidity	41.0%

Product Service

2.2.7 Test Results

2401 MHz

Fundamental

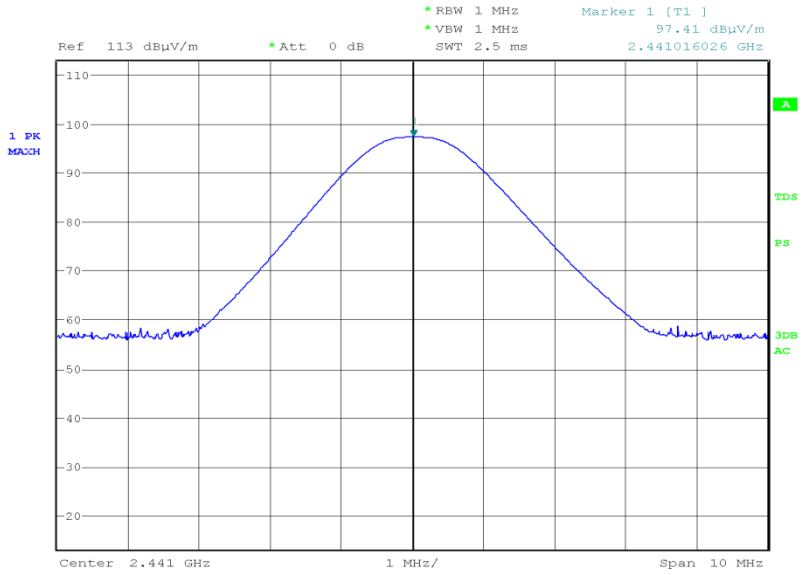


Date: 7.APR.2014 20:04:37

Frequency (MHz)	Result (dBµv/m)	Limit (dBµv/m)
2402	82.50	93.98

2441 MHz

Fundamental



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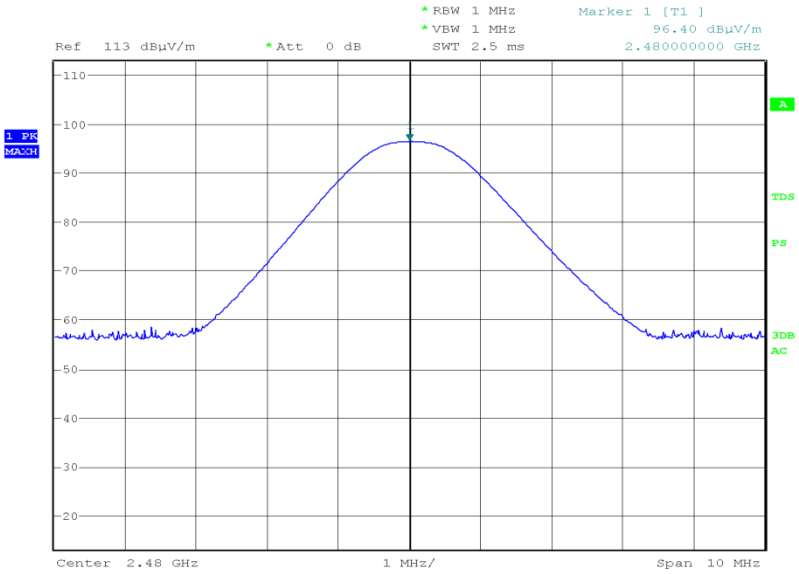
Frequency (MHz)	Result (dBµv/m)	Limit (dBµv/m)
2441	80.54	98.98

2480 MHz

Fundamental



Frequency (MHz)	Result (dBµv/m)	Limit (dBµv/m)
2480	79.53	93.98

Limit Clause 15.249 (a) and A2.9

Fundamental Frequency (MHz)	Field Strength of Fundamental (millivolts/meter)
902 to 928	50
2400 to 2483.5	50
5725 to 5875	50
24000 to 24250	250

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

SHL25 S/N: IMEI 004401115170256 - Modification State 0

2.3.3 Date of Test

7 April 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 30MHz to 18GHz the EUT is placed on a test table 800mm above the ground plane. For frequencies above 18GHz, the EUT height is increased by 200mm to a height of 1000mm. 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 30MHz to 1GHz range are measured using a CISPR Quasi – Peak detector function in a 120kHz bandwidth. Emissions in the range 1GHz to 40GHz require Peak and Average measurements. The Peak measurements are made using a peak detector with 1MHz Resolution and Video bandwidths. The average measurements employ a peak detector with a Resolution bandwidth of 1MHz and a Video bandwidth of 10Hz. If measurements are made at a 1m measuring distance, then 10dB is added to the specification limit.

2.3.6 Environmental Conditions

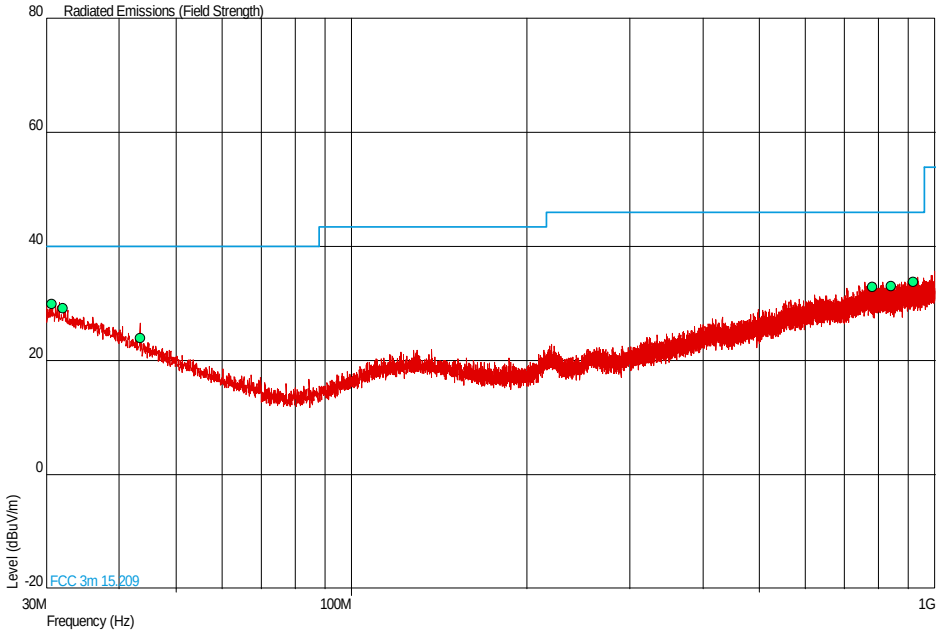
Ambient Temperature	20.9°C
Relative Humidity	41.0%

Product Service

2.3.7 Test Results

2401 MHz

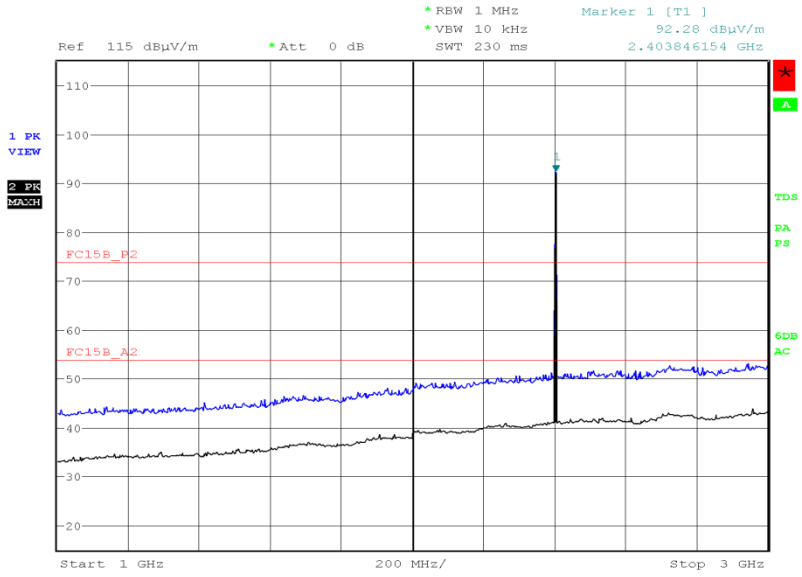
30 MHz to 1 GHz



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
30.631	29.9	31.3	40.0	100	-10.1	68.7	0	1.00	Vertical
31.989	29.1	28.5	40.0	100	-10.9	71.5	45	1.00	Vertical
43.435	24.0	15.8	40.0	100	-16.0	84.2	45	1.00	Vertical
780.004	32.9	44.2	46.0	200	-13.1	155.8	45	1.00	Vertical
842.133	33.0	44.7	46.0	200	-13.0	155.3	45	1.00	Vertical
916.968	33.9	49.5	46.0	200	-12.1	150.5	45	1.00	Vertical

Product Service

1 GHz to 3 GHz



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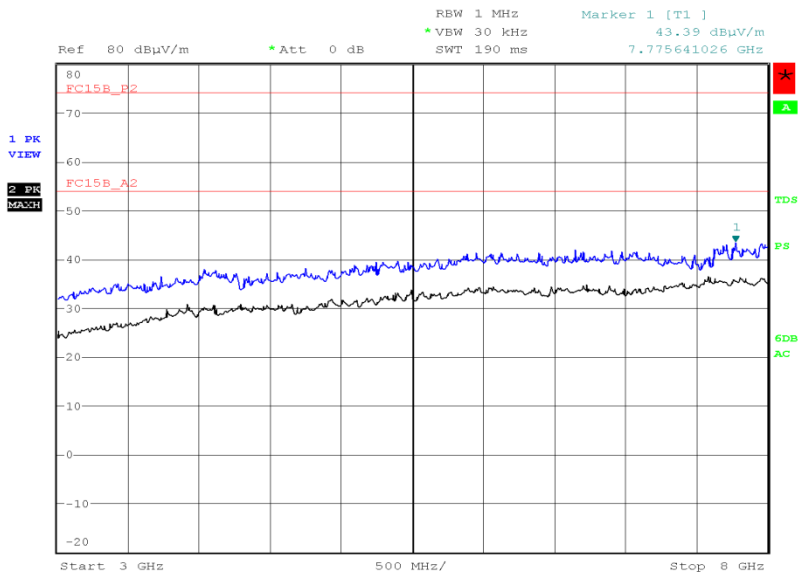
3 GHz to 8 GHz



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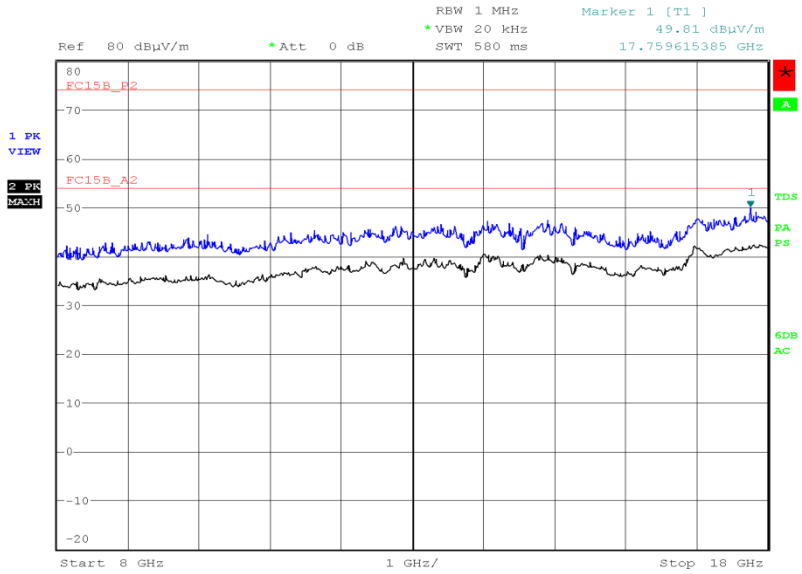
Product Service

8 GHz to 18 GHz



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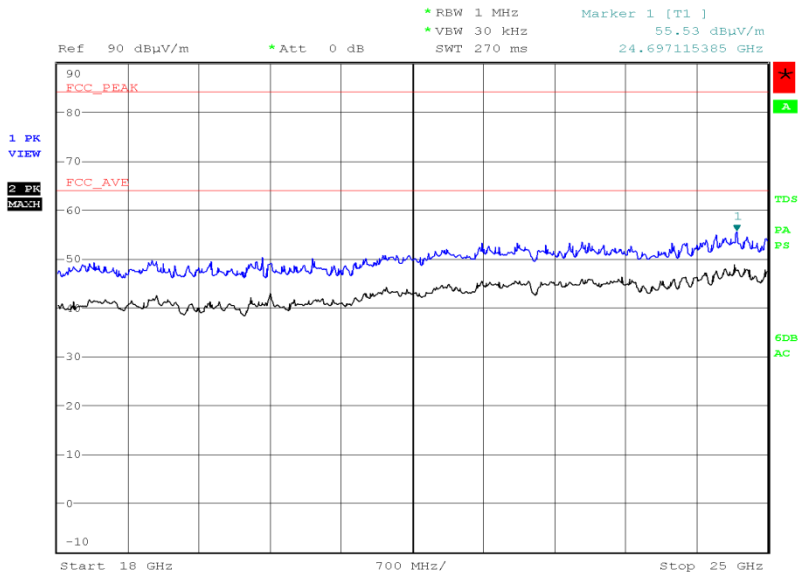
18 GHz to 25 GHz



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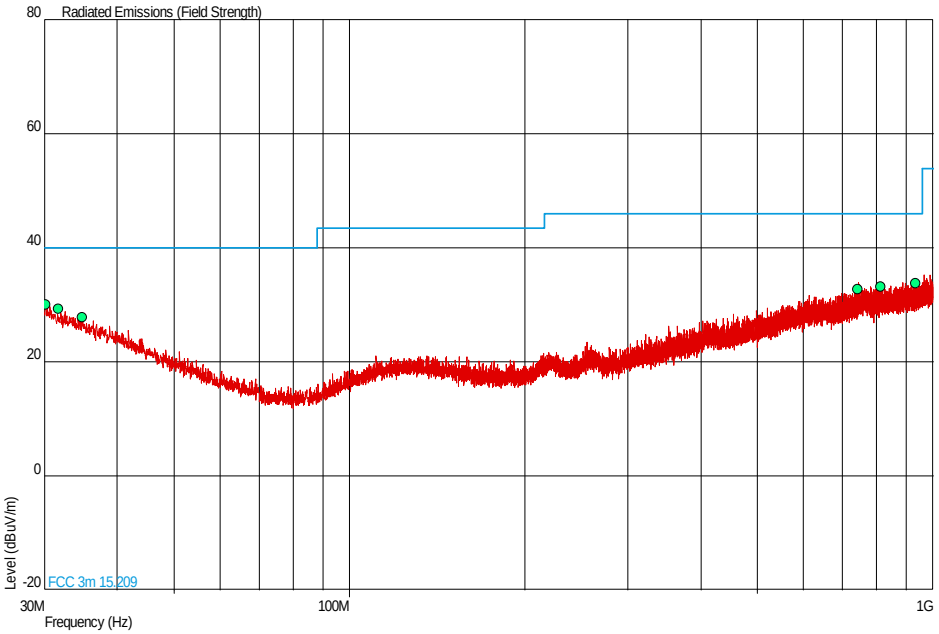
2441 MHz

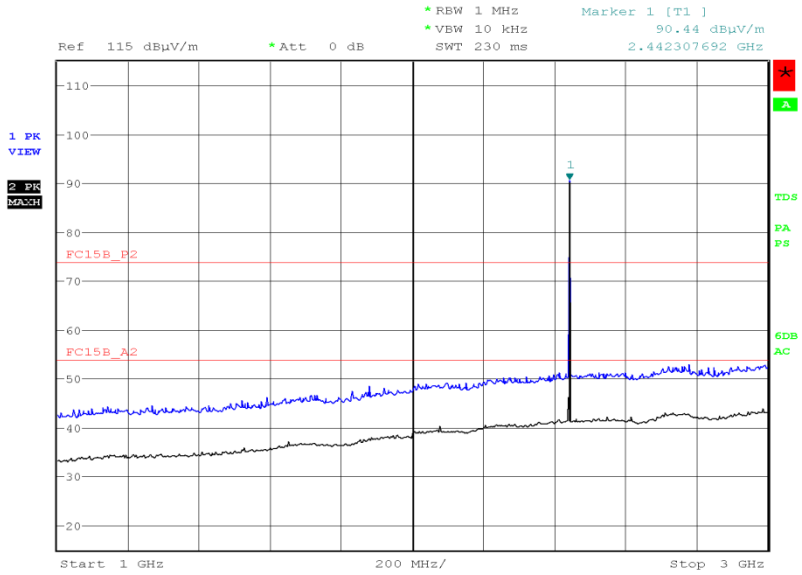
30 MHz to 1 GHz



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
30.146	30.1	32.0	40.0	100	-9.9	68.0	0	1.00	Vertical
31.698	29.3	29.2	40.0	100	-10.7	70.8	0	1.00	Vertical
34.802	27.9	24.8	40.0	100	-12.1	75.2	45	1.00	Vertical
742.853	32.8	43.7	46.0	200	-13.2	156.3	0	1.00	Vertical
812.354	33.2	45.7	46.0	200	-12.8	154.3	0	1.00	Vertical
932.682	33.8	49.0	46.0	200	-12.2	151.0	0	1.00	Vertical

Product Service

1 GHz to 3 GHz



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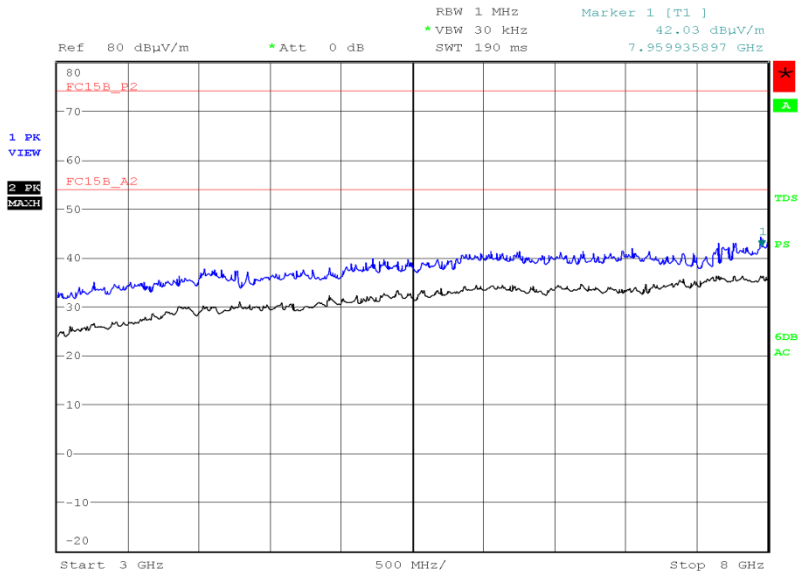
3 GHz to 8 GHz



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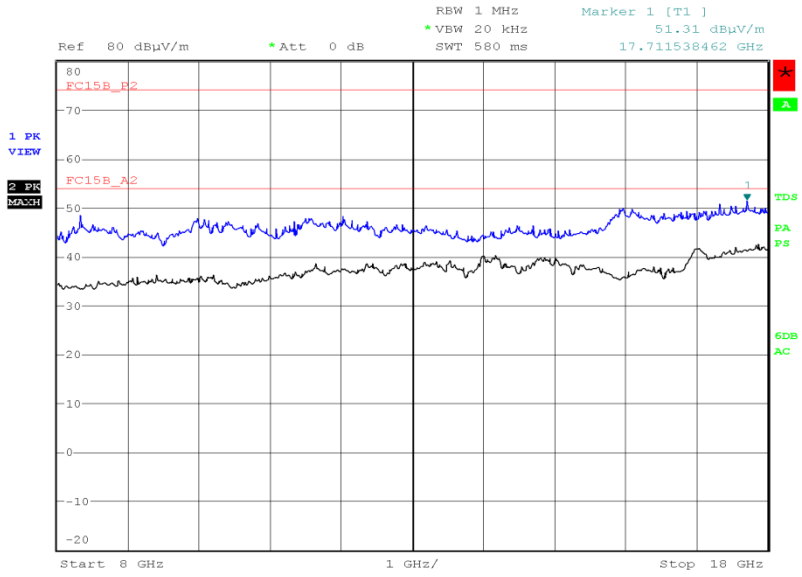
Product Service

8 GHz to 18 GHz



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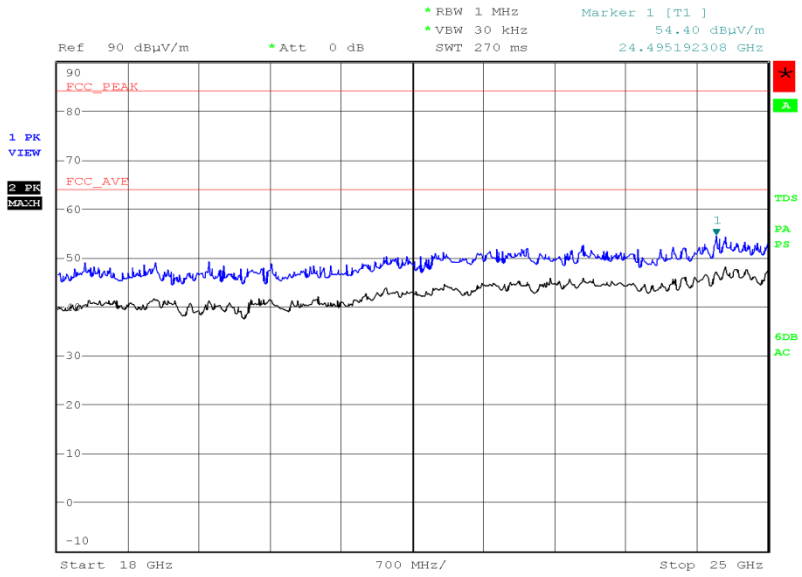
18 GHz to 25 GHz



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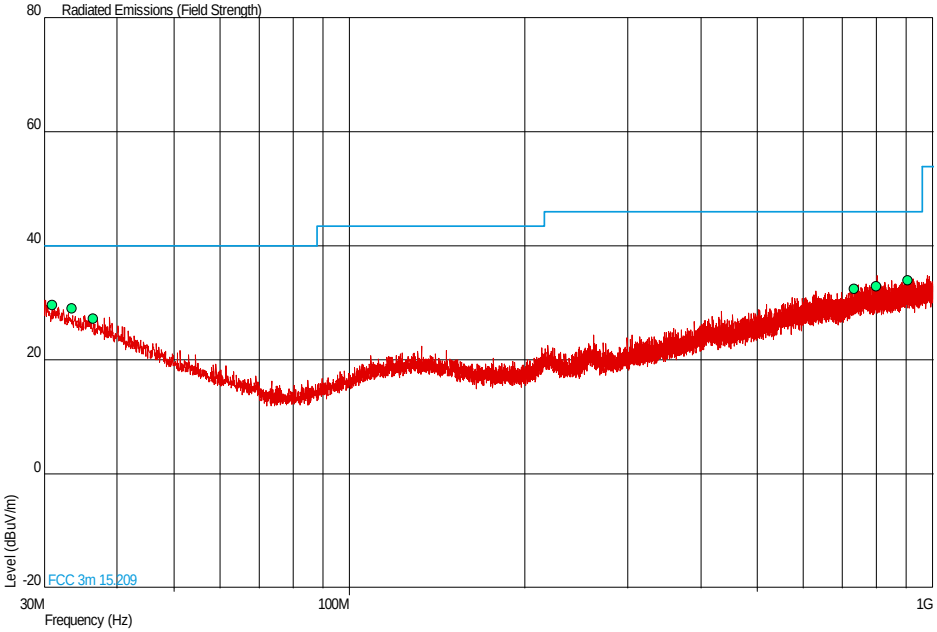
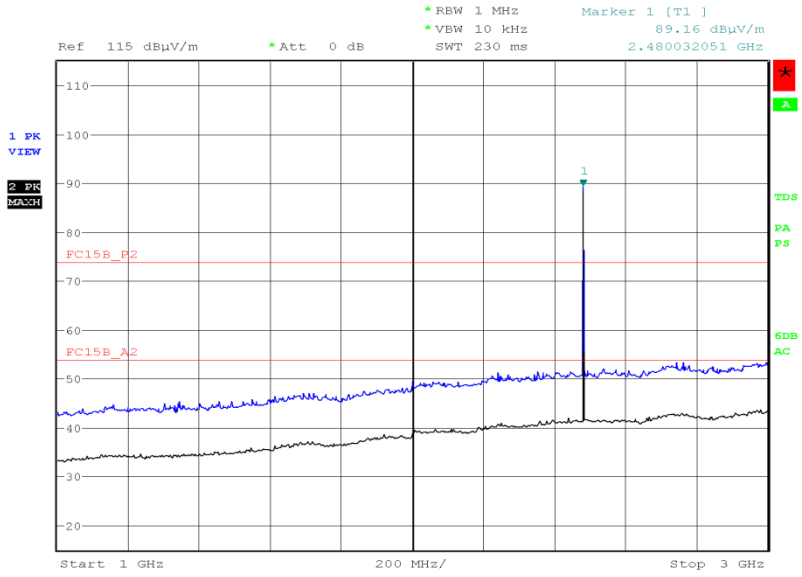
2480 MHz

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
31.019	29.7	30.5	40.0	100	-10.3	69.5	45	1.00	Vertical
33.444	29.0	28.2	40.0	100	-11.0	71.8	45	1.00	Vertical
36.354	27.3	23.2	40.0	100	-12.7	76.8	45	1.00	Vertical
731.892	32.4	41.7	46.0	200	-13.6	158.3	45	1.00	Vertical
799.999	32.9	44.2	46.0	200	-13.1	155.8	45	1.00	Vertical
905.571	33.9	49.5	46.0	200	-12.1	150.5	0	1.00	Vertical

1 GHz to 3 GHz



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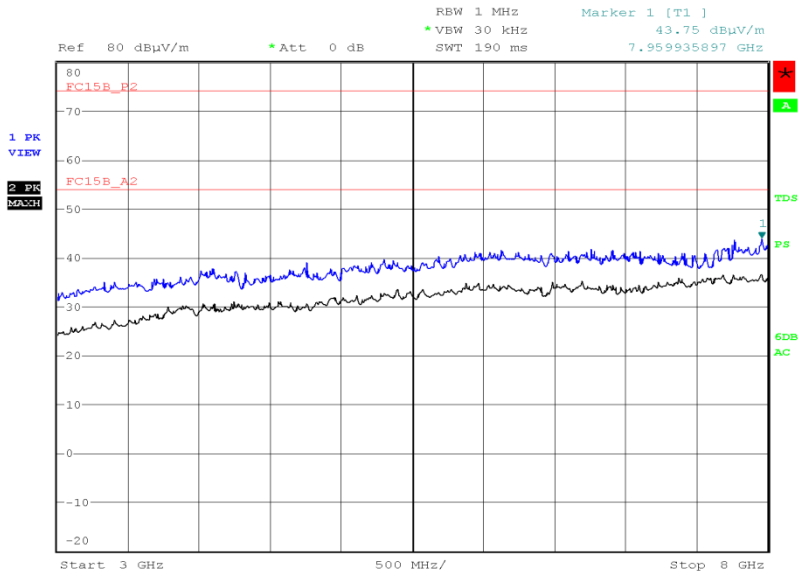
3 GHz to 8 GHz



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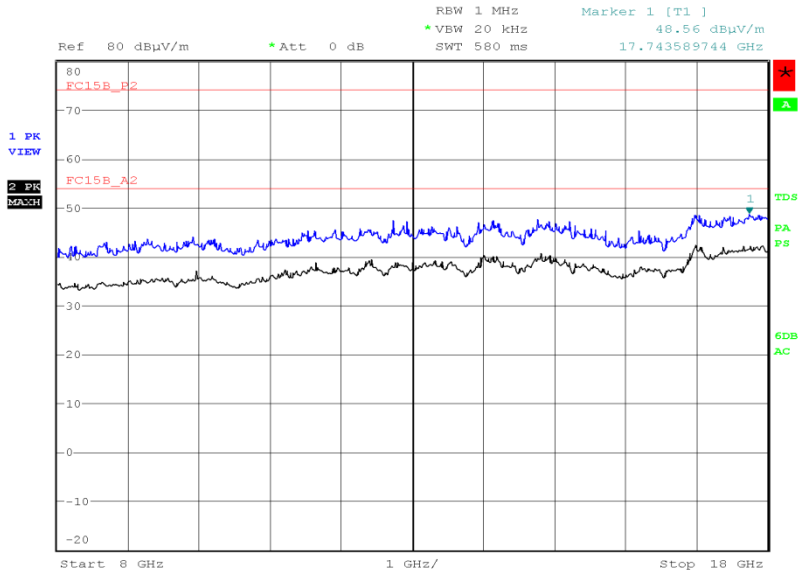
Product Service

8 GHz to 18 GHz



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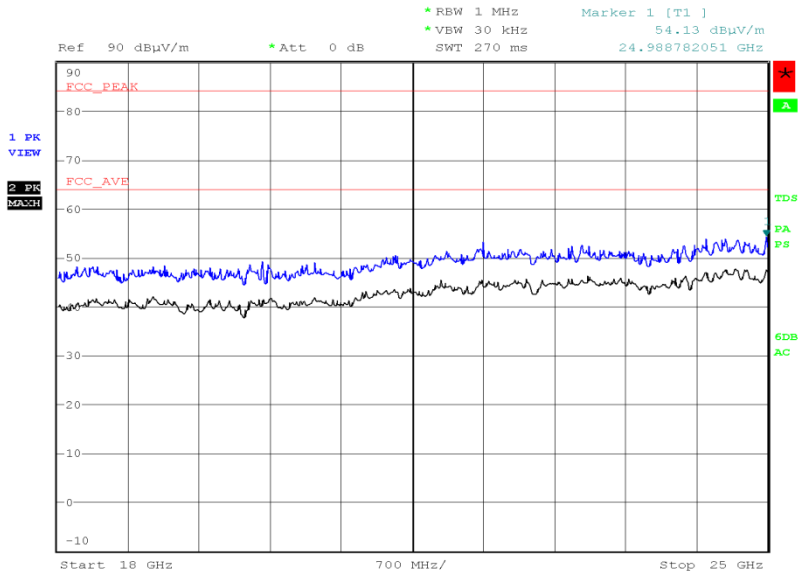
18 GHz to 25 GHz



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Limit Clause

15.249 (a) and A2.9

Fundamental Frequency (MHz)	Field Strength of Harmonics (microvolts/meter)
902 to 928	500
2400 to 2483.5	500
5725 to 5875	500
24000 to 24250	2500

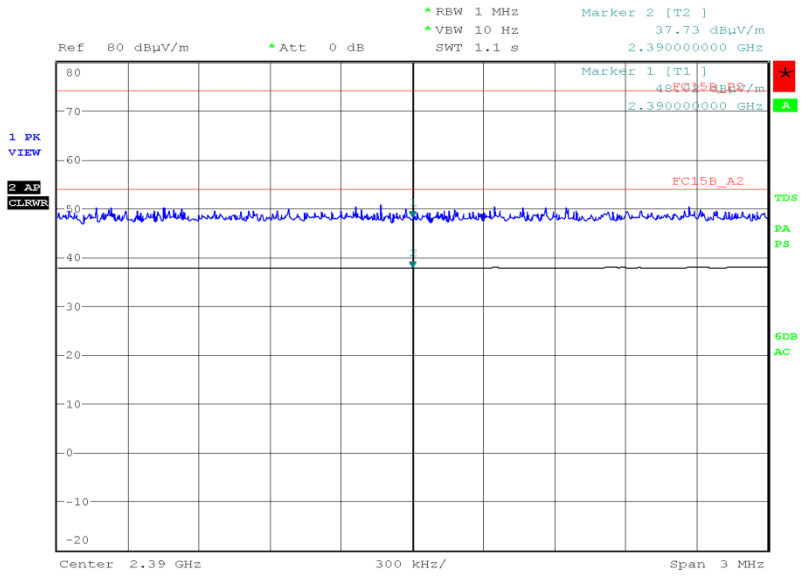
15.249 (d), 15.209

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

Band Edge Emissions

2401 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Horizontal	48.02	37.73



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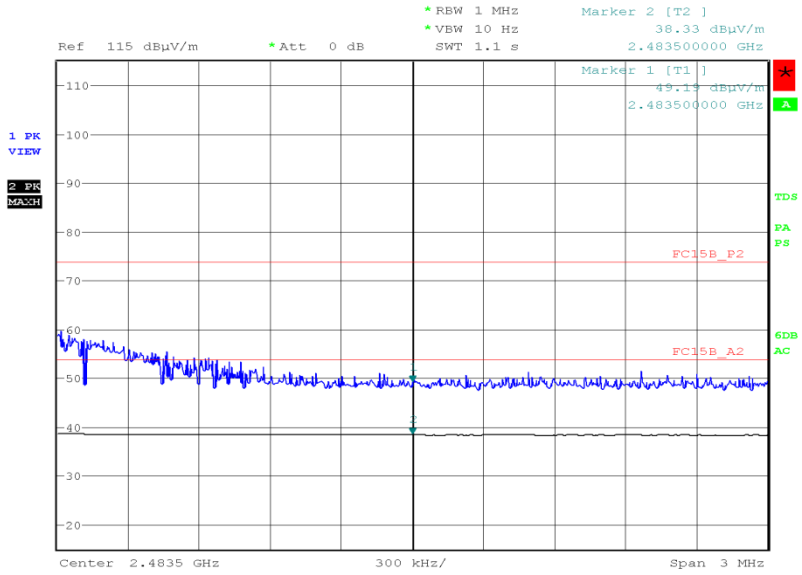
2480 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Horizontal	49.19	38.33



Date: 7.APR.2014 18:10:55

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					
Transient Limiter	Hewlett Packard	11947A	15	12	10-Dec-2014
LISN (1 Phase)	Chase	MN 2050	336	12	28-Mar-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
Section 2.2 - Field Strength of Fundamental					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	3-May-2014
Screened Room (5)	Rainford	Rainford	1545	24	10-Jan-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Section 2.3 - Field Strength of any Emission					
Antenna (Active Loop, 9kHz-30MHz)	Rohde & Schwarz	HFH2-Z2	333	24	30-Oct-2014
Antenna (Dish/Tripod/Adaptor, 1GHz-18GHz)	Rohde & Schwarz	AC-008	334	-	TU
Screened Room (5)	Rainford	Rainford	1545	24	10-Jan-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU

TU – Traceability Unscheduled

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

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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

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

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).