



TEST REPORT

Test Report No. : UL-RPT-RP10014948JD14A V2.0

Manufacturer : Sony Mobile Communications AB
Type No. : PM-0450-BV
FCC ID : PY7PM-0450
Technology : RFID – 13.56 MHz
Test Standard(s) : FCC Parts 15.207, 15.209(a) & 15.225

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2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

Date of Issue: 17 July 2013

Checked by:

Sarah Williams
WiSE Laboratory Engineer

Issued by :

pp

John Newell
Group Quality Manager, WiSE
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This laboratory is accredited by UKAS.
The tests reported herein have been
performed in accordance with its' terms
of accreditation.

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Table of Contents

1. Customer Information.....	4
2. Summary of Testing.....	5
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	5
2.4. Deviations from the Test Specification	5
3. Equipment Under Test (EUT)	6
3.1. Identification of Equipment Under Test (EUT)	6
3.2. Description of EUT	7
3.3. Modifications Incorporated in the EUT	7
3.4. Additional Information Related to Testing	8
3.5. Support Equipment	8
4. Operation and Monitoring of the EUT during Testing	9
4.1. Operating Modes	9
4.2. Configuration and Peripherals	9
5. Measurements, Examinations and Derived Results	10
5.1. General Comments	10
5.2. Test Results	11
5.2.1. Transmitter AC Conducted Spurious Emissions	11
5.2.2. Transmitter Fundamental Field Strength	15
5.2.3. Transmitter Radiated Spurious Emissions	17
5.2.4. Transmitter Band Edge Radiated Emissions	20
5.2.5. Transmitter 20 dB Bandwidth	22
5.2.6. Transmitter Frequency Stability (Temperature & Voltage Variation)	23
6. Measurement Uncertainty	25
7. Report Revision History	26

1. Customer Information









Company Name:	Sony Mobile Communications AB
Address:	Nya Vattentorget Lund SE-221 88 Sweden

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.225
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Radio Frequency Devices) - Section 15.225
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	20 June 2013 to 12 July 2013

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	
Part 15.225(a)(b)(c)(d)	Transmitter Fundamental Field Strength	
Part 15.209(a), 15.225(d)	Transmitter Radiated Spurious Emissions	
Part 15.209(a), 15.225(c)(d)	Transmitter Band Edge Radiated Emissions	
Part 2.1049	Transmitter 20 dB Bandwidth	
Part 15.225(e)	Transmitter Frequency Stability (Temperature & Voltage Variation)	
Key to Results		
 = Complied  = Did not comply		

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2009)
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Reference:	ANSI C63.10 (2009)
Title:	American National Standard for Testing Unlicensed Wireless Devices

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Sony
IMEI:	004402451217172 <i>(Radiated sample #1)</i>
Serial Number:	CB5124TU0G
Hardware Version Number:	AP2
Software Version Number:	14.1.G.1.241
FCC ID:	PY7PM-0450

Brand Name:	Sony
IMEI:	004402451220135 <i>(Radiated sample #2)</i>
Serial No	CB5124TU87
Hardware Version Number:	AP2
Software Version Number:	14.1.G.1.241
FCC ID:	PY7PM-0450

Brand Name:	Sony
IMEI:	004402451239333 <i>(Radiated sample #3 modified with 50 Ohm load for AC conducted emission test only)</i>
Serial No	CB5124VXHT
Hardware Version Number:	AP2
Software Version Number:	14.1.G.1.241
FCC ID:	PY7PM-0450

Brand Name:	Sony
IMEI:	004402451243434 <i>(Radiated sample #4 modified with Dummy Battery)</i>
Serial Number:	CB5124TU8W
Hardware Version Number:	AP2
Software Version Number:	14.1.G.1.241
FCC ID:	PY7PM-0450

Identification of Equipment Under Test (EUT) (continued)

Brand Name:	Sony
Description:	AC Charger
Model Name or Number:	EP880

Brand Name:	Generic
Description:	MHL Cable
Model Name or Number:	Not marked or stated

Brand Name:	Sony
Description:	MHL Adaptor
Model Name or Number:	IM750

Brand Name:	Sony
Description:	Magnetic Plug
Model Name or Number:	EC801

Brand Name:	Sony
Description:	USB cable
Model Name or Number:	EC21

Brand Name:	Sony
Description:	PHF
Model Name or Number:	MH750

3.2. Description of EUT

The equipment under test (EUT) is a model of GSM/UMTS/LTE mobile phone with integrated antenna and inbuilt Li-Polymer battery.

The EUT supports GSM 850/900/1800/1900MHz bands, WCDMA FDD bands 1/2/4/5/8 and LTE FDD bands 1/2/3/4/5/7/8/20. It also supports GPRS service with multi-slots class 33 and EGPRS service with multi-slots class 33 too. The HSDPA and HSUPA features are also supported. It has MP3, camera, FM radio, USB memory, GPS receiver, NFC, Mobile High-Definition Link (MHL), Bluetooth (EDR and Bluetooth 4.0), WLAN (802.11 a/b/g/n/ac) and Wi-Fi hotspot functions.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Tested Technology:	RFID	
Category of Equipment:	Transceiver	
Channel Spacing:	Single channel device	
Transmit Frequency Range:	13.56 MHz	
Receive Frequency Range:	13.56 MHz	
Power Supply Requirement:	Nominal	3.8 V
	Minimum	3.23 V
	Maximum	4.37 V
Tested Temperature Range:	Minimum	-20°C
	Maximum	50°C

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Brand Name:	Generic
Description:	2 GB Micro SD Card
Model Name or Number:	Not marked or stated

Description:	RFID tag
Brand Name:	Sony
Model Name or Number:	AI-1400 (salvor)
Hardware Version Number:	DP

Brand Name:	Logik
Description:	22" High Definition Television
Model Name or Number:	L22FE12A
Serial Number:	1309020661

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- Constantly transmitting at full power with a modulated carrier in RFID test mode.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- The RFID transmitter test mode was enabled by running a Customer specific application on the handset. The application scans until an RFID tag is placed near the RFID antenna of the handset which enables a continuously modulated RFID mode.
- Transmitter radiated spurious emission tests were performed with the following configurations, employing all available accessories:
 - Configuration 1 – Handset with the AC charger, USB Cable, MHL cable (terminated in to a television), MHL adaptor and PHF.
 - Configuration 2 – Handset with the AC charger, Magnetic plug and PHF.

Pre-scans below 1 GHz were performed in both configurations 1 and 2, with final measurements limited to the configuration which provided worst case results. Pre-scans above 1 GHz were performed in the configuration that employed the most accessories (Configuration 1), with any final measurements being performed in both configurations.

- Testing at voltage extremes was performed with a dummy battery fitted to the EUT, which was supplied by the Customer.
- AC conducted emissions tests were performed with the EUT connected to the AC charger. The AC charger was connected to a 120 VAC 60 Hz single phase supply via a LISN.
- The RFID antenna was disconnected and replaced with a 50 Ohm dummy load in order to comply with the requirements of the AC conducted emissions test in transmit mode. The standard antenna was connected for all other tests.
- Radiated sample with IMEI 004402451217172 was used for fundamental field strength, spurious emissions, band edge radiated emissions and 20 dB bandwidth tests.
- Radiated samples with IMEI 004402451239333 & 004402451220135 were used for the AC conducted emission test.
- Radiated sample with IMEI 004402451243434 was used for the Transmitter Frequency Stability test.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6: Measurement Uncertainties* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Nick Steele	Test Date:	12 th July 2013
Test Sample IMEI:	004402451239333		

FCC Reference:	Part 15.207
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	44

Note(s):

1. The EUT was initially tested with the standard antenna connected. The carrier at 13.56 MHz was found to be non-compliant as it exceeded the test limit. The Customer modified the EUT by disconnecting the standard antenna and fitting a load with the same electrical properties in accordance with ANSI C63.10 Section 6.2.5 and FCC KDB 174176. The test was then repeated and the EUT was found to be compliant.

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.154	Live	47.2	65.8	18.6	Complied
0.164	Live	45.7	65.3	19.6	Complied
0.195	Live	42.0	63.8	21.8	Complied
0.438	Live	35.2	57.1	21.9	Complied
1.014	Live	37.4	56.0	18.6	Complied
1.338	Live	39.8	56.0	16.2	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.447	Live	25.6	46.9	21.3	Complied
0.829	Live	23.5	46.0	22.5	Complied
1.144	Live	25.1	46.0	20.9	Complied
1.275	Live	25.1	46.0	20.9	Complied

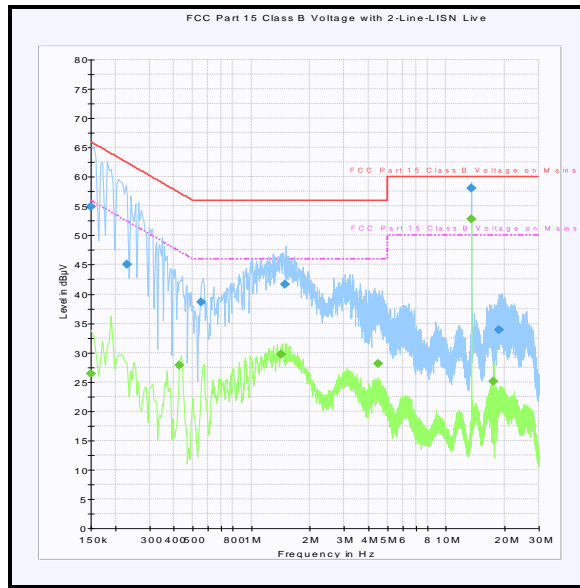
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.159	Neutral	51.6	65.5	13.9	Complied
0.163	Neutral	50.6	65.3	14.7	Complied
0.231	Neutral	47.1	62.4	15.3	Complied
0.325	Neutral	40.0	59.6	19.6	Complied
1.392	Neutral	35.9	56.0	20.1	Complied

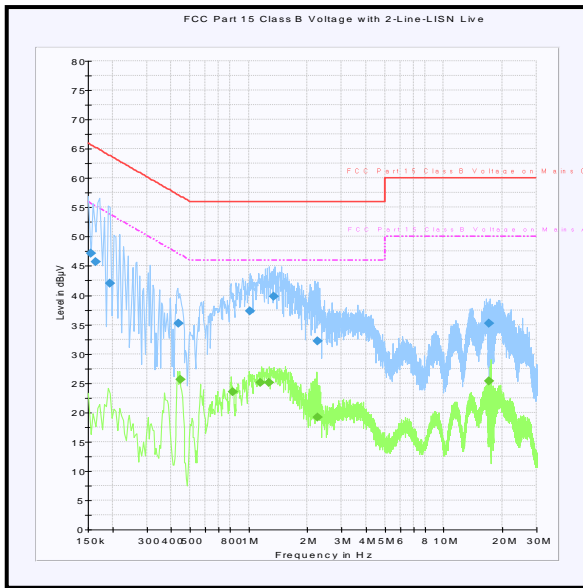
Results: Neutral / Average

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.438	Neutral	23.6	47.1	23.5	Complied
1.252	Neutral	25.0	46.0	21.0	Complied
3.115	Neutral	23.6	46.0	22.4	Complied
16.980	Neutral	22.6	50.0	27.4	Complied

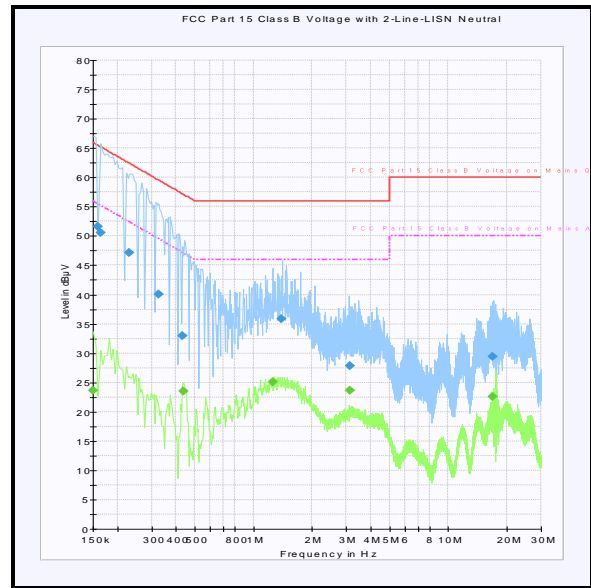
Transmitter AC Conducted Spurious Emissions (continued)



Pre-scan test prior to modification of the EUT (standard antenna)



Live



Neutral

Test results with modified sample (transmitter terminated into 50 Ohm load)

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter AC Conducted Spurious Emissions (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1625	Thermometer / Hygrometer station	JM Handelpunkt	30.5015.13	None stated	09 Jan 2014	12
A004	LISN	Rohde & Schwarz	ESH3-Z5	890604/027	30 Oct 2013	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	19 Feb 2014	12
M1020	Test Receiver	Rohde & Schwarz	SME-03	834617/030	14 Dec 2013	12

5.2.2. Transmitter Fundamental Field Strength

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	21 June 2013
Test Sample IMEI:	004402451217172		

FCC Reference:	Part 15.225(a)(b)(c)(d)
Test Method Used:	ANSI C63.10 Section 6.4

Environmental Conditions:

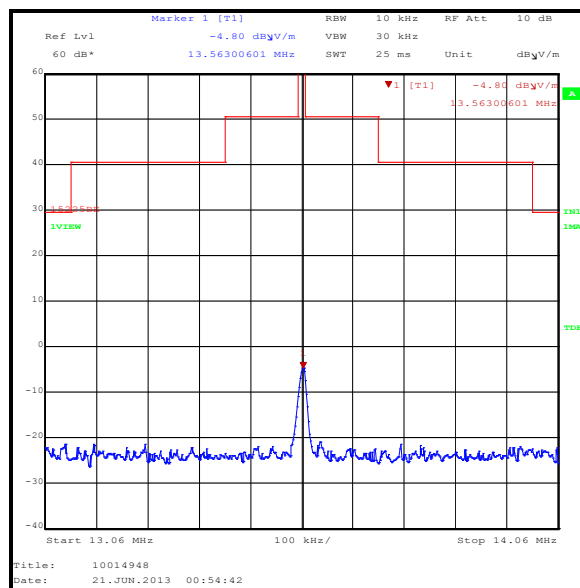
Temperature (°C):	24
Relative Humidity (%):	49

Note(s):

1. The limit is specified at a test distance of 30 metres. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40dB/decade).
2. A transducer factor on the measuring instrument was used to extrapolate the results at 3 metres to a distance of 30 metres. A distance extrapolation factor of 40 dB was used.
3. Pre-scans were performed with a peak detector. Final measurements were performed with a quasi-peak detector.

Results: Quasi Peak

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit at 30 m (dB μ V/m)	Margin (dB)	Result
13.56	90° to EUT	-5.0	84.0	89.0	Complied



Transmitter Fundamental Field Strength (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0001	5 m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	07 Feb 2014	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	12 Feb 2014	12
M1622	Thermometer / Hygrometer station	JM Handelpunkt	30.5015.13	Not stated	24 May 2014	12

5.2.3. Transmitter Radiated Spurious Emissions**Test Summary:**

Test Engineer:	Andrew Edwards	Test Dates:	20 June 2013 & 21 June 2013
Test Sample IMEI:	004402451217172		

FCC Reference:	Parts 15.225(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3, 6.4 and 6.5 referencing ANSI C63.4
Frequency Range:	9 kHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	48 to 56

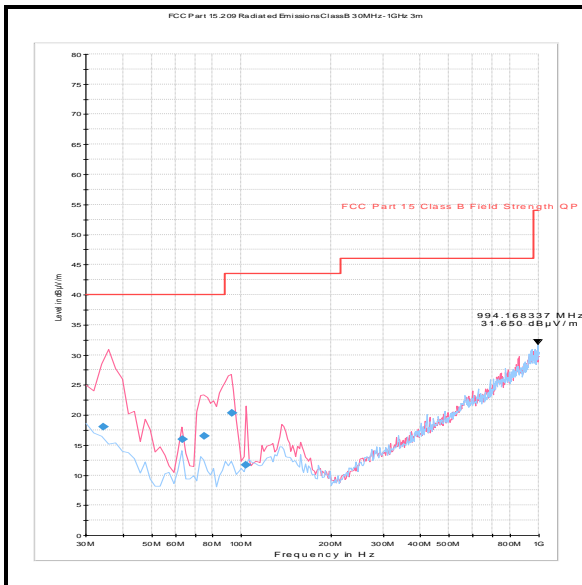
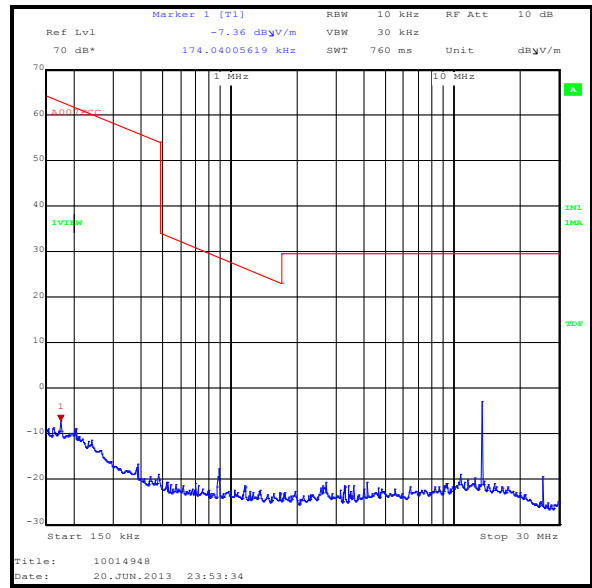
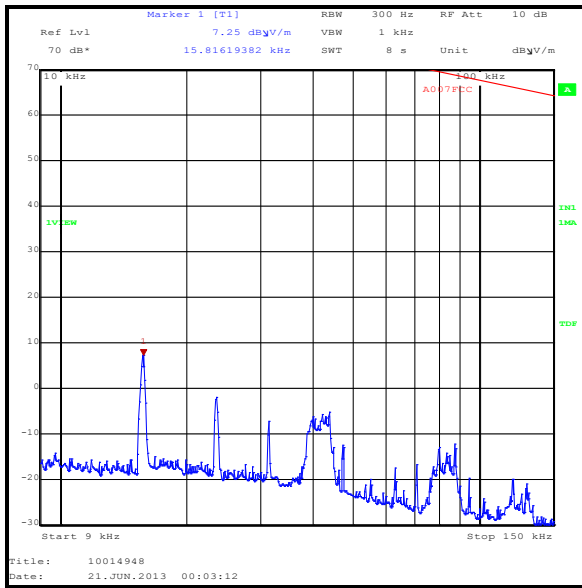
Note(s):

- Limits below 30 MHz are specified at a test distance of 30 metres, whilst below 0.49 MHz they are specified at a test distance of 300 metres. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40dB/decade).
- A transducer factor on the measuring instrument was used to extrapolate the results at 3 metres to a distance of 30 metres where required. A distance extrapolation factor of 40 dB was used.
- Final measurement values include corrections for antenna factor and cable losses.
- The emission shown at approximately 13.56 MHz is the fundamental.
- All emissions on the 9 kHz to 150 kHz plot were investigated and found to be radiating from the test site turntable.
- The emission at 25.343 MHz was investigated and found to be an ambient emission.
- All other emissions shown on the pre-scan plots were investigated and found to be >20 dB below the applicable limit or below the measurement system noise floor therefore the highest measurement system noise floor is recorded in the table below.
- Measurements in the range 30 MHz to 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Results: Quasi Peak

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
994.168	Vertical	31.7	54.0	22.3	Complied

Transmitter Radiated Spurious Emissions (continued)



Transmitter Radiated Spurious Emissions (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A490	Antenna	Chase	CBL6111A	1590	18 Apr 2014	12
A1834	Attenuator	Hewlett Packard	8491B	10444	27 Jan 2014	12
G0543	Pre-Amplifier	Sonoma	310N	230801	04 Jul 2013	3
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	07 Feb 2014	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	12 Feb 2014	12
M1622	Thermometer / Hygrometer station	JM Handelpunkt	30.5015.13	Not stated	24 May 2014	12

5.2.4. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	21 June 2013
Test Sample IMEI:	004402451217172		

FCC Reference:	Parts 15.225(c)(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Section 6.9.2

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	49

Note(s):

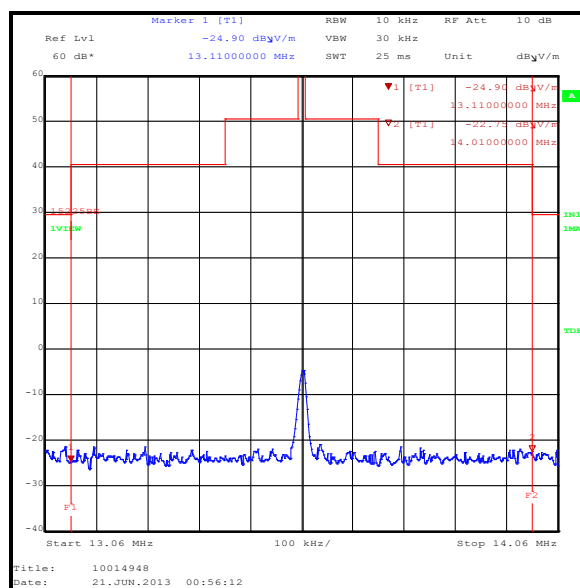
1. A transducer factor on the measuring instrument was used to extrapolate the results at 3 metres to a distance of 30 metres where required. A distance extrapolation factor of 40 dB was used.

Results: Quasi Peak Lower Band Edge

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
13.11	-32.4	29.5	61.9	Complied

Results: Quasi Peak Upper Band Edge

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
14.01	-32.2	29.5	61.7	Complied



Transmitter Band Edge Radiated Emissions (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	07 Feb 2014	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	12 Feb 2014	12
M1622	Thermometer / Hygrometer station	JM Handelpunkt	30.5015.13	Not stated	24 May 2014	12

5.2.6. Transmitter Frequency Stability (Temperature & Voltage Variation)**Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	11 July 2013
Test Sample IMEI:	004402451243434		

FCC Reference:	Part 15.225(e)
Test Method Used:	As detailed in ANSI C63.10 Section 6.8.1 and 6.8.2

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	37

Results: Maximum frequency error of the EUT with variations in ambient temperature

Temperature (°C)	Time after Start-up			
	0 minutes	2 minutes	5 minutes	10 minutes
-20	13.559709 MHz	13.559722 MHz	13.559715 MHz	13.559694 MHz
20	13.559832 MHz	13.559832 MHz	13.559832 MHz	13.559832 MHz
50	13.559767 MHz	13.559765 MHz	13.559763 MHz	13.559762 MHz

Frequency with Worst Case Deviation (MHz)	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Margin (%)	Result
13.559694	306	0.002257	0.01	0.007743	Complied

Results: Maximum frequency error of the EUT with variations in nominal operating voltage at an ambient temperature of 20°C

Supply Voltage (V)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Margin (%)	Result
3.23	13.56	13.559833	167	0.001232	0.01	0.008768	Complied
3.8	13.56	13.559832	168	0.001239	0.01	0.008761	Complied
4.37	13.56	13.559831	169	0.001246	0.01	0.008754	Complied

Transmitter Frequency Stability (Temperature & Voltage Variation) (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
E0513	Environmental Chamber	TAS	LT600 Series 3	23900506	Calibrated before use	-
L1076	Spectrum Analyser	Rohde & Schwarz	FSU 8	101349	29 May 2014	12
M1269	Multimeter	Fluke	179	90250210	30 Jul 2013	12
M1643	Thermometer	Fluke	52II	18890136	19 Mar 2014	12
M1659	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
S0557	DC power supply	TTI	EL303R	395819	Calibrated before use	-

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
20 dB Bandwidth	13 MHz to 14 MHz	95%	±0.92 ppm
Frequency Stability	13 MHz to 14 MHz	95%	±0.92 ppm
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	±3.73 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±5.65 dB
Transmitter Fundamental Field Strength	13 MHz to 14 MHz	95%	±3.73 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version
2.0	-	-	Model No. removed