




TEST REPORT


Test Report No. : UL-RPT-RP10295122JD01I V2.0

Manufacturer : Sony Mobile Communications Inc.
FCC ID : PY7PM-0801
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: 31 July 2014

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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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1. Customer Information









Company Name:	Sony Mobile Communications Inc.
Address:	Nya Vattentornet Mobilvägen 10 Lund 22188 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:	31 May 2014 to 06 June 2014

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 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:	004402452752532 <i>(Radiated sample #1)</i>
Test Sample Serial Number:	CB5A1Z1RY4
Hardware Version Number:	A
Software Version Number:	23.0.D.0.91
FCC ID:	PY7PM-0801

Brand Name:	Sony
IMEI:	004402452753035 <i>(Radiated sample #2 modified with 50 Ohm load for AC conducted emission test only)</i>
Test Sample Serial Number:	CB5A1Z1S3L
Hardware Version Number:	A
Software Version Number:	23.0.D.0.91
FCC ID:	PY7PM-0801

Brand Name:	Sony
IMEI:	004402452749512 <i>(Conducted sample with RF port)</i>
Test Sample Serial Number:	CB5A1Z1S2N
Hardware Version Number:	A
Software Version Number:	23.0.D.0.91
FCC ID:	PY7PM-0801

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

Brand Name:	Monoprice
Description:	MHL Cable
Model Name or Number:	Not marked

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

Identification of Equipment Under Test (EUT) (continued)

Brand Name:	Sony
Description:	USB Cable
Model Name or Number:	EC803

Brand Name:	Sony
Description:	Deskstand
Model Name or Number:	DK43

Brand Name:	Sony
Description:	PHF
Model Name or Number:	MH410c

3.2. Description of EUT

The equipment under test (EUT) was a GSM/WCDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n/ac + NFC & ANT+.

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	
Power Supply Requirement:	Nominal	3.8 V
	Minimum	3.42 V
	Maximum	4.18 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:

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

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

Brand Name:	Sony
Description:	RFID Tag
Model Name or Number:	AI-1400

Description:	Test jig
Brand Name:	Not marked
Model Name or Number:	Not marked
Serial Number:	Not marked

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 means of running the customer bespoke application on the handset. An RFID tag was placed near the handset to enable a continuously modulated RFID transmitter.
- 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, USB Cable, Deskstand 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 all accessories; AC charger, USB Cable, MHL cable (terminated in to a television), MHL adaptor and PHF. 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 004402452752532 was used for fundamental field strength, radiated spurious emissions, band edge radiated emissions and 20 dB bandwidth tests.
- Radiated sample with IMEI 004402452753035 was used for AC conducted emission test.
- Radiated sample with IMEI 004402452749512 was used for 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:	Georgios Vrezas	Test Date:	03 June 2014
Test Sample IMEI:	004402452753035		

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):	22
Relative Humidity (%):	56

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
0.200	Live	43.4	63.6	20.2	Complied
0.213	Live	41.6	63.1	21.5	Complied
0.456	Live	31.1	56.8	25.7	Complied
1.127	Live	27.5	56.0	28.5	Complied
14.208	Live	36.5	60.0	23.5	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.227	Live	25.7	52.6	26.9	Complied
0.245	Live	23.5	51.9	28.4	Complied
0.483	Live	27.8	46.3	18.5	Complied
0.942	Live	17.7	46.0	28.3	Complied
1.428	Live	16.6	46.0	29.4	Complied
14.474	Live	25.3	50.0	24.7	Complied

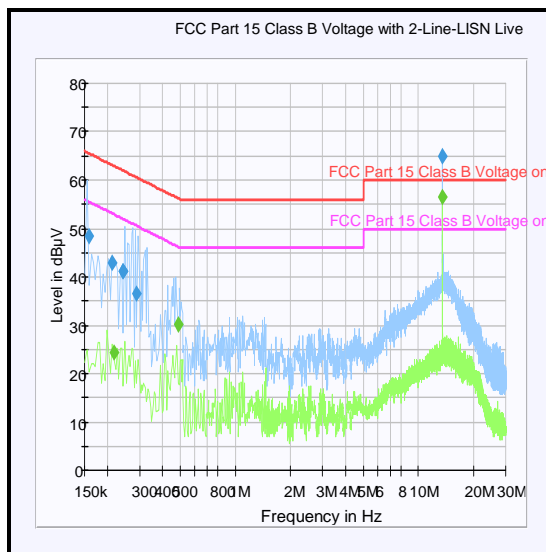
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.150	Neutral	46.6	66.0	19.4	Complied
0.173	Neutral	45.0	64.8	19.8	Complied
0.177	Neutral	44.3	64.6	20.3	Complied
0.213	Neutral	41.3	63.1	21.8	Complied
0.483	Neutral	39.5	56.3	16.8	Complied
0.807	Neutral	30.3	56.0	25.7	Complied
14.397	Neutral	39.3	60.0	20.7	Complied

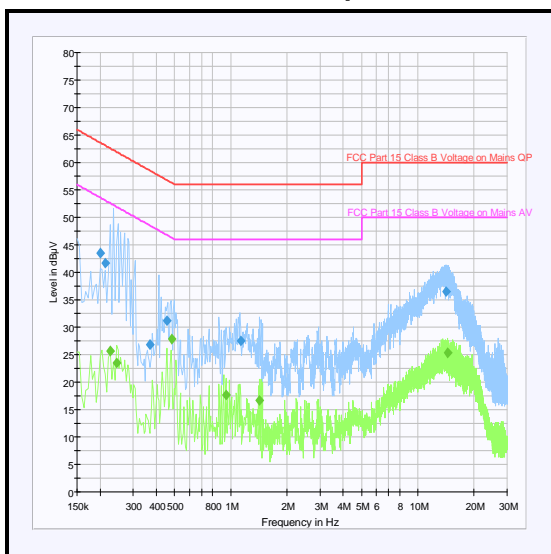
Results: Neutral / Average

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.227	Neutral	30.6	52.6	22.0	Complied
0.245	Neutral	28.9	51.9	23.0	Complied
0.483	Neutral	33.0	46.3	13.3	Complied
0.839	Neutral	25.4	46.0	20.6	Complied
1.428	Neutral	23.1	46.0	22.9	Complied
16.085	Neutral	28.0	50.0	22.0	Complied

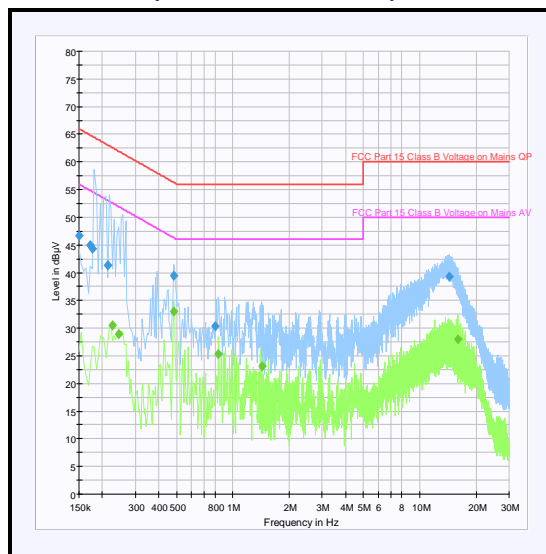
Transmitter AC Conducted Spurious Emissions (continued)



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.

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1625	Thermohygrometer	JM Handlungspunkt	30.5015.06	None stated	31 Dec 2014	12
A004	LISN	Rohde & Schwarz	ESH3-Z5	890604/027	18 Nov 2014	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	27 Feb 2015	12
M1263	Test Receiver	Rohde & Schwarz	ESIB 7	100265	14 Oct 2014	12

5.2.2. Transmitter Fundamental Field Strength

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	31 May 2014
Test Sample IMEI:	004402452752532		

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

Environmental Conditions:

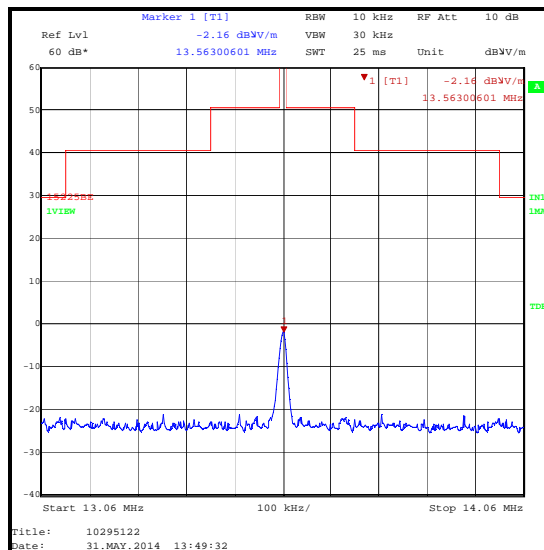
Temperature (°C):	24
Relative Humidity (%):	33

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 (dBµV/m)	Limit at 30 m (dBµV/m)	Margin (dB)	Result
13.56	90°to EUT	-2.6	84.0	86.6	Complied



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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1622	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	31 Dec 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Nov 2014	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	26 Feb 2015	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2014	12

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

Test Engineer:	Andrew Edwards	Test Dates:	31 May 2014 & 02 June 2014
Test Sample IMEI:	004402452752532		

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):	24
Relative Humidity (%):	33 to 34

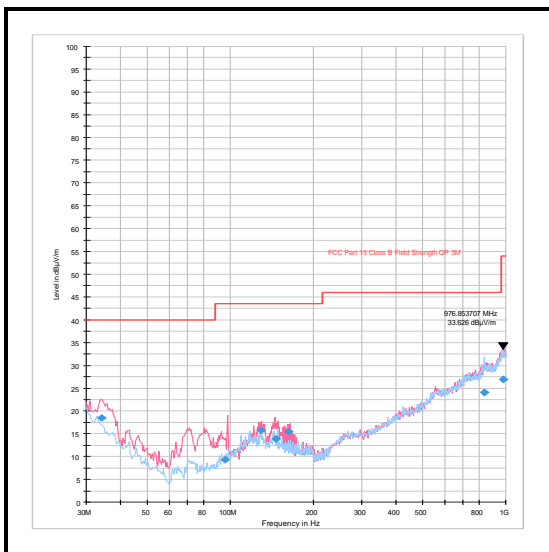
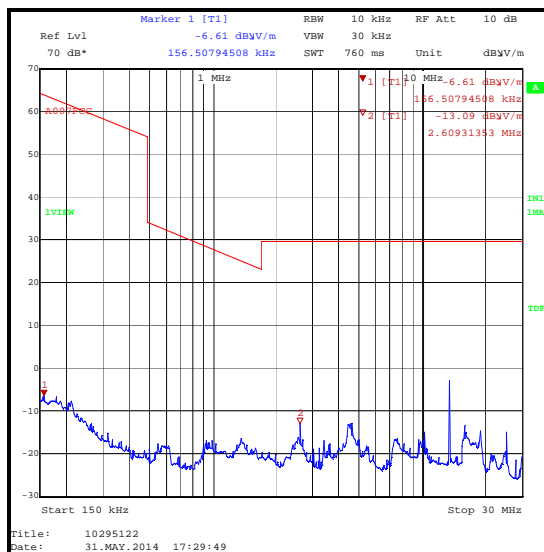
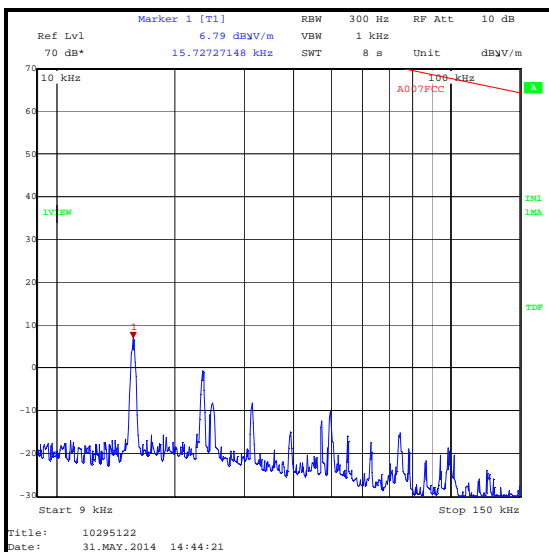
Note(s):

- 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.
- 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:

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
976.854	Vertical	33.6	46.0	12.4	Complied

Transmitter Radiated Spurious Emissions (continued)



Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1622	Thermohygrometer	JM Handlungspunkt	30.5015.13	None stated	31 Dec 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Nov 2014	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	26 Feb 2015	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2015	12
A490	Antenna	Chase	CBL6111A	1590	29 Apr 2015	12
A1834	Attenuator	Hewlett Packard	8491B	10444	15 Nov 2014	12
G0543	Amplifier	Sonoma	310N	230801	19 Aug 2014	3

5.2.4. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	31 May 2014
Test Sample IMEI:	004402452752532		

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 (%):	33

Note(s):

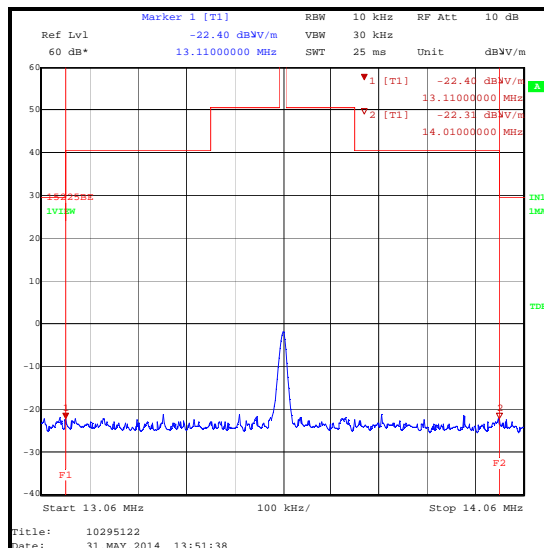
1. A transducer factor on the measuring instrument was used to extrapolate the results at 3 metres to a distance of 30 metres where required. A distance extrapolation factor of 40 dB was used.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

Results: Quasi Peak Lower Band Edge

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
13.11	-32.1	29.5	61.6	Complied

Results: Quasi Peak Upper Band Edge

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
14.01	-32.0	29.5	61.5	Complied



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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1622	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	31 Dec 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Nov 2014	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	26 Feb 2015	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2014	12

5.2.5. Transmitter 20 dB Bandwidth

Test Summary:

Test Engineer:	Andrew Edwards	Test Date:	31 May 2014
Test Sample IMEI:	004402452752532		

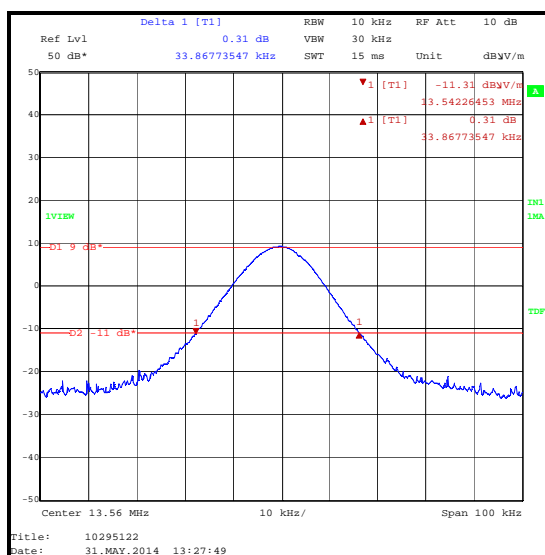
FCC Reference:	Part 2.1049
Test Method Used:	As detailed in ANSI C63.10 Section 6.9.1

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	34

Results:

20 dB Bandwidth (kHz)
33.868



Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1622	Thermohygrometer	JM Handelpunkt	30.5015.13	None stated	31 Dec 2014	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	26 Feb 2015	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2014	12

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

Test Engineer:	Georgios Vrezas	Test Date:	06 June 2014
Test Sample IMEI:	004402452749512		

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:

Ambient Temperature (°C):	24
Ambient Relative Humidity (%):	40

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	13.559368 MHz	13.559365 MHz	13.559359 MHz	13.559349 MHz
20	13.559323 MHz	13.559323 MHz	13.559327 MHz	13.559324 MHz
50	13.559248 MHz	13.559247 MHz	13.559247 MHz	13.559246 MHz

Frequency with Worst Case Deviation (MHz)	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Margin (%)	Result
13.559246	754	0.005560	0.01	0.004440	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
3.42	13.56	13.559333	667	0.004919	0.01	0.005081	Complied
3.8	13.56	13.559323	677	0.004993	0.01	0.005007	Complied
4.18	13.56	13.559332	668	0.004926	0.01	0.005074	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)
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
E0513	Environmental Chamber	TAS	LT600 Series 3	23900506	Calibrated before use	-
S021	DC power supply	Thurlby Thandar Instruments	CPX200	061034	Calibrated before use	-
M1251	Multimeter	Fluke	175	89170179	19 May 2015	12
M1249	Thermometer	Fluke	52II	88800049	02 May 2015	12
L1128	Signal Analyser	Rohde & Schwarz	FSV13	101835	25 Apr 2015	12

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%	±3.92 %
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	-	-	EUT Description update

--- END OF REPORT ---