TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Test of: Plextek Ltd
LoJack P5A Transceiver

To: FCC Part 90: 2006

Test Report Serial No:
RFI/RPTE3/RP49278JD01A

Supersedes Test Report Serial No:
RFI/RPTE2/RP49278JD01A

This Test Report Is Issued Under The Authority Of Michael Derby, Radio Performance Service Leader: 	
Tested By: Petr Hajek  **pp**	**Checked By: Michael Derby** 
Report Copy No: PDF01	
Issue Date: 26 July 2007	**Test Dates: 06 June 2007 to 08 June 2007**

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RFI Global Services Ltd
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire RG23 8BG
Telephone: +44 (0)1256 312000 Facsimile: +44 (0)1256 312001
Email: info@rfi-global.com Website: www.rfi-global.com

Registered in England and Wales. Company number:2117901

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1. Client Information

Company Name:	Plextek Ltd
Address:	London Road Great Chesterford Essex CB10 1NY UK
Contact Name:	Mr G Smith

2. Equipment Under Test (EUT)

The following information (with the exception of the Date of Receipt) has been supplied by the client:

2.1. Identification of Equipment Under Test (EUT)

Description:	Vehicle Tracking Transceiver
Brand Name:	LoJack
Model Name or Number:	P5A
Serial Number:	RC001
Hardware Version Number:	40P1CD08
Software Version Number:	40S030108
FCC ID Number:	IDIP5A
Country of Manufacture:	Malaysia
Date of Receipt:	05 June 2007

Description:	Vehicle Tracking Transceiver
Brand Name:	LoJack
Model Name or Number:	P5A
Serial Number:	RC003
Hardware Version Number:	40P1CD08
Software Version Number:	40S030108
FCC ID Number:	IDIP5A
Country of Manufacture:	Malaysia
Date of Receipt:	05 June 2007

Description:	Vehicle Tracking Transceiver
Brand Name:	LoJack
Model Name or Number:	P5A
Serial Number:	RC004
Hardware Version Number:	40P1CD08
Software Version Number:	40S030108
FCC ID Number:	IDIP5A
Country of Manufacture:	Malaysia
Date of Receipt:	05 June 2007

2.2. Description of EUT

The following description was supplied by the customer:

The LoJack system is implemented on a single VHF Radio channel using propriety hardware and software operating a LoJack defined protocol.

When a P5A equipped vehicle is reported stolen by the owner, the stolen car tracking authority enters the thief information into a central computer system. The central computer system then arranges the activation of the Vehicles Locating Unit (P5A) by dispatching messages to a network of base stations called Remote Transceiver Unit (RTU).

Once a P5A has been activated, it transmits a Reply (Tracking) message repeatedly unit deactivated by the RTU. The P5A will transmit the reply at a rapid rate ("Tracing Mode"). The P5A may also report activation automatically via an uplink message.

The vehicle tracking receiver (VTU) locks on to the P5A signal when it is within range and gives directional information as well as an indication of distance using signal strength.

The vehicle tracking receiver is typically used in a police mobile vehicle to track and locate the stolen vehicle.

The P5A is a module that monitors the RF channel for commands addressed to it. When a valid command addressed to the P5A is received, the unit will perform the action associated with the command.

2.3. Modifications Incorporated in the EUT

During the course of testing the EUT was not modified.

2.4. Additional Information Related to Testing

Power Supply Requirement:	External DC Battery Supply of 3.6 V		
Intended Operating Environment:	Vehicular, Commercial, Light Industry, Heavy Industry		
Equipment Category:	Private Mobile Radio (PMR)		
Type of Unit:	Transceiver		
Interface Ports:	External DC Battery Supply connection		
Transmit Frequency Range:	Single Channel		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Single Channel	N/A	173.075
Receive Frequency Range:	Single Channel		
Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Single Channel	N/A	173.075
Highest Fundamental Frequency (MHz):	173.075		
Occupied Bandwidth (kHz):	10.972		

2.5. Support Equipment

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

Description:	AC Coupled Nominal Modulation Bleep Box
Brand Name:	Plextek
Model Name or Number:	None stated
Serial Number:	None stated
Cable Length and Type:	1m, Coax 1m, Serial Cable 12V DC Cable
Connected to Port:	Support Signal Generator Support Laptop Serial Port Support DC Supply

Description:	Signal Generator
Brand Name:	Marconi Instruments
Model Name or Number:	M1 2022C
Serial Number:	P163
Cable Length and Type:	1m, Coax
Connected to Port:	Support AC Coupled Nominal Modulation Bleep Box

Description:	Laptop
Brand Name:	Hewlett Packard
Model Name or Number:	OMNI Book 6100
Serial Number:	None Stated
Cable Length and Type:	1m, Serial Cable
Connected to Port:	Support AC Coupled Nominal Modulation Bleep Box

3. Test Specification, Methods and Procedures

3.1. Test Specifications

Reference:	FCC Part 90: 2006
Title:	Code of Federal Regulations, Part 15 (47CFR290) Radio Frequency Devices.

3.2. Methods and Procedures

The methods and procedures used were as detailed in:

ANSI/TIA-603-B-2003
Land Mobile Communications Equipment, Measurements and performance Standards

ANSI C63.2 (1987)
Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2001)
Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)
Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)
Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1: (1999)
Title: Specification For Radio Disturbance and Immunity Measuring Apparatus and Methods.
Part 1: Radio Disturbance and Immunity Measuring Apparatus.

3.3. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

4. Deviations from the Test Specification

There were no deviations from the test specification.

5. Operation of the EUT During Testing

5.1. Operating Modes

The EUT was tested in the following operating modes, unless otherwise stated:

Tracking Mode – The EUT transmits a 200 ms burst, every 1000 ms.

Receive Mode – The EUT is in constant Receive Mode.

Slow Mode – The EUT randomly transmits 200 ms bursts.

5.2. Configuration and Peripherals

The EUT was tested in the following configuration:

The EUT was connected to external battery of 3.6 V DC.

The EUT antenna was expanded to full length and attached to a non-metallic support for the duration of the test.

The EUT was programmed remotely (wireless), using commands from the support computer, modulation box and signal generator.

6. Summary of Test Results

Range of Measurements	Specification Reference	Port Type	Compliancy Status
Receiver Radiated Spurious Emissions	C.F.R. 47 FCC Part 15: 2006 Section 15.109	Enclosure	Complied
Receiver AC Conducted Spurious Emissions	C.F.R. 47 FCC Part 15: 2006 Section 15.107	AC Mains	Not tested (Note 1)
Transmitter Carrier Output Power (ERP)	C.F.R. 47 FCC Part 90: 2006 Sections 90.20(e)(6) TIA-603-B Section 2.2.11	Antenna	Complied (Note 2)
Transmitter Occupied Bandwidth (Bandwidth Limitations)	C.F.R. 47 FCC Part 90: 2006 Sections 90.209 / 90. 20(e)(6) / 2.1049	Antenna	Complied
Transmitter Radiated Emissions Masks	C.F.R. 47 FCC Part 90: 2006 Sections 90.210 TIA-603-B Section 2.2.12	Antenna	Complied
Transmitter Radiated Emissions (Out of Band)	C.F.R. 47 FCC Part 90: 2006 Sections 90.210 TIA-603-B Section 2.2.12	Antenna	Complied
Transmitter Frequency Stability (Temperature & Voltage Variation)	C.F.R. 47 FCC Part 90: 2006 Sections 90.213/2.1055 TIA-603-B Section 2.2.2	Antenna	Complied
Transmitter Transient Frequency Behaviour	C.F.R. 47 FCC Part 90: 2006 Sections 90.214 TIA-603-B Section 2.2.19	Antenna	Complied
Transmitter Duty Cycle	C.F.R. 47 FCC Part 90: 2003 Section 90.20(e)(6)	Antenna	Complied

Note 1: The EUT is battery powered for a vehicular environment

Note 2: The EUT antenna was fixed and no antenna port was available, therefore the ERP was measured radiated.

6.1. Location of Tests

All the measurements described in this report were performed at the premises of
RFI Global Services Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, UK.

FCC Site Registration Number: 90895

IC Site Registration Number: 3485

7. Measurements, Examinations and Derived Results

7.1. General Comments

This section contains test results only.

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 8 for details of measurement uncertainties.

7.2. Receiver Radiated Spurious Emissions

7.2.1. Electric Field Strength Measurements (Frequency Range: 30 MHz to 1000 MHz)

The EUT was configured for radiated emissions testing, as described in Section 9 of this report.

Tests were performed to identify the maximum receiver or standby radiated emission levels.

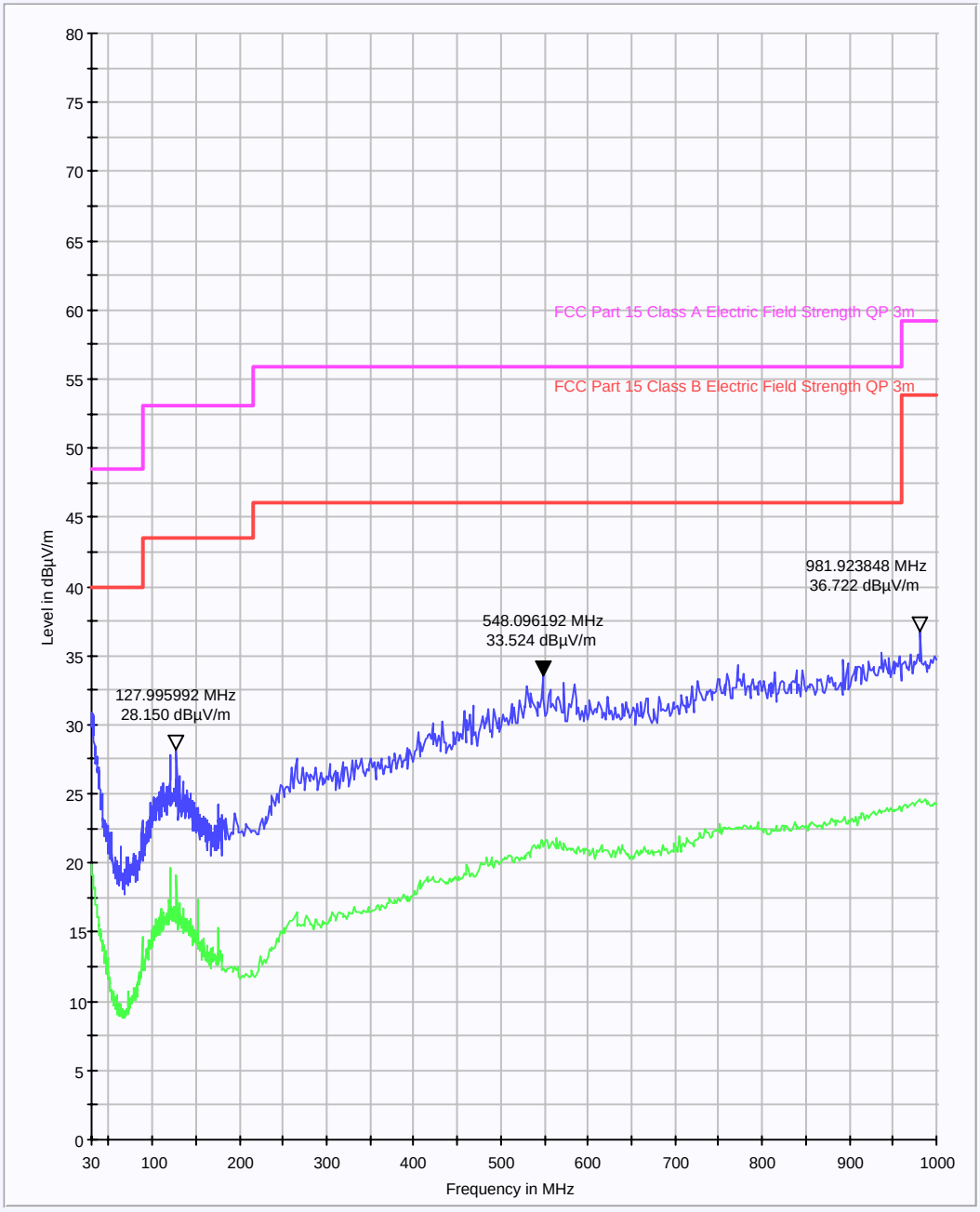
Results:

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
127.995	Vertical	28.2	43.5	15.3	Complied
548.096	Vertical	33.5	46.0	12.5	Complied
981.923	Vertical	36.7	54.0	17.3	Complied

Note(s):

1. *No significant emissions were observed above the test site noise floor, so the highest levels of noise were measured.*
2. *The noise levels were measured with a peak detector and compared to the quasi-peak limit.*

Receiver Mode Radiated Spurious Emissions (Continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

Receiver Radiated Emissions (Continued)

7.2.2. Electric Field Strength Measurements (Frequency Range: 1 GHz to 2 GHz)

Results:

Highest Peak Level:

Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Transducer Factor (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
1.154308	Vertical	55.4	-9.9	45.5	74.0	28.5	Complied
1.877755	Vertical	53.0	-6.3	46.7	74.0	27.3	Complied

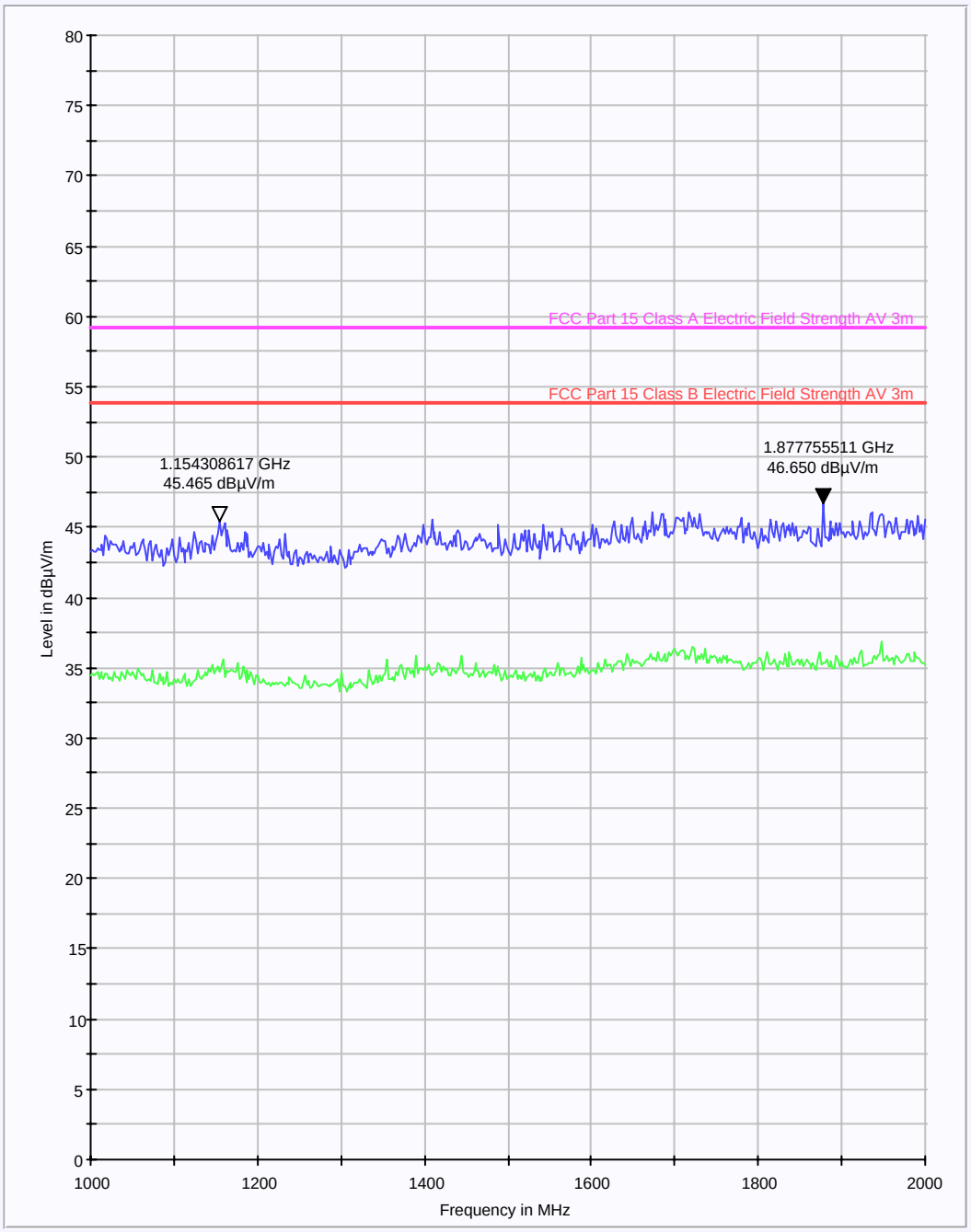
Highest Average Level:

Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Transducer Factor (dB)	Actual Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
1.154308	Vertical	55.4	-9.9	45.5	54.0	8.5	Complied
1.877755	Vertical	53.0	-6.3	46.7	54.0	7.3	Complied

Note(s):

1. *No significant emissions were observed above the test site noise floor, so the highest levels of noise were measured.*
2. *The noise levels were measured with a peak detector and compared to the average limit.*

Receiver Radiated Emissions (Continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

7.3. Transmitter Carrier Output Power (ERP)

The EUT was configured for transmitter carrier output power (ERP), as described in Section 9 of this report. Tests were performed to identify the EUT maximum radiated transmit power.

Results:

Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Margin (dB)	Result
Single	173.075	26.4	34.0	6.6	Complied

7.4. Transmitter Occupied Bandwidth

The EUT was configured for Occupied Bandwidth measurements, as described in Section 9 of this report.

Tests were performed to identify the maximum bandwidth occupied by the fundamental frequency of the EUT.

Results:

Channel	Frequency (MHz)	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Single	173.075	0.5	2	10.972	20.0	9.028	Complied

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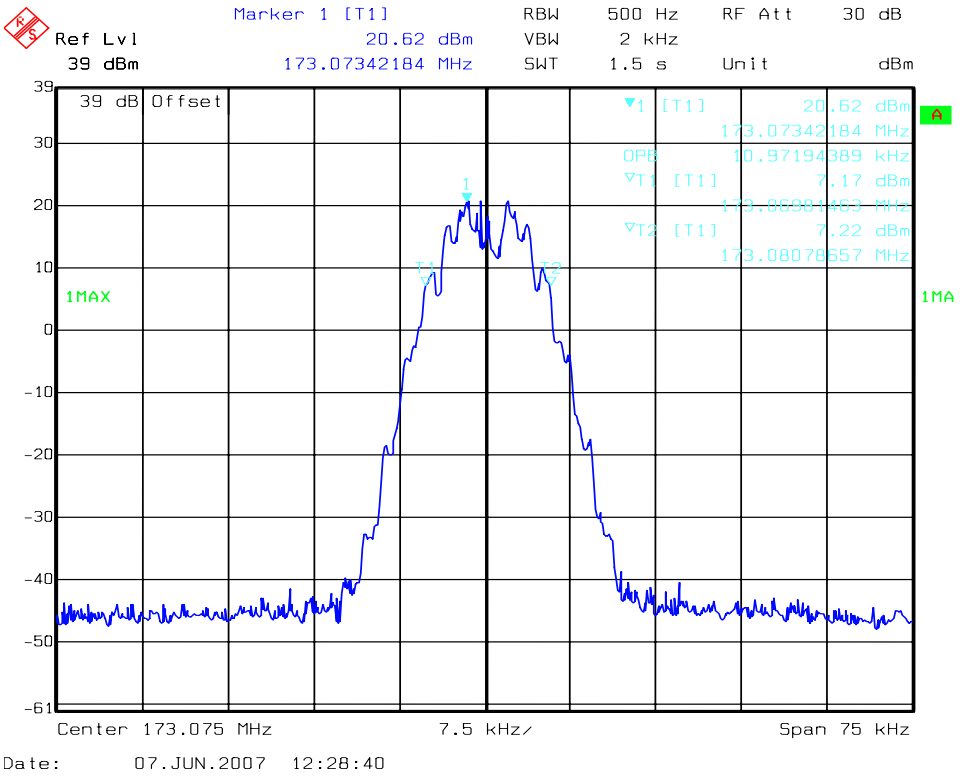
Transmitter Occupied Bandwidth (Continued)



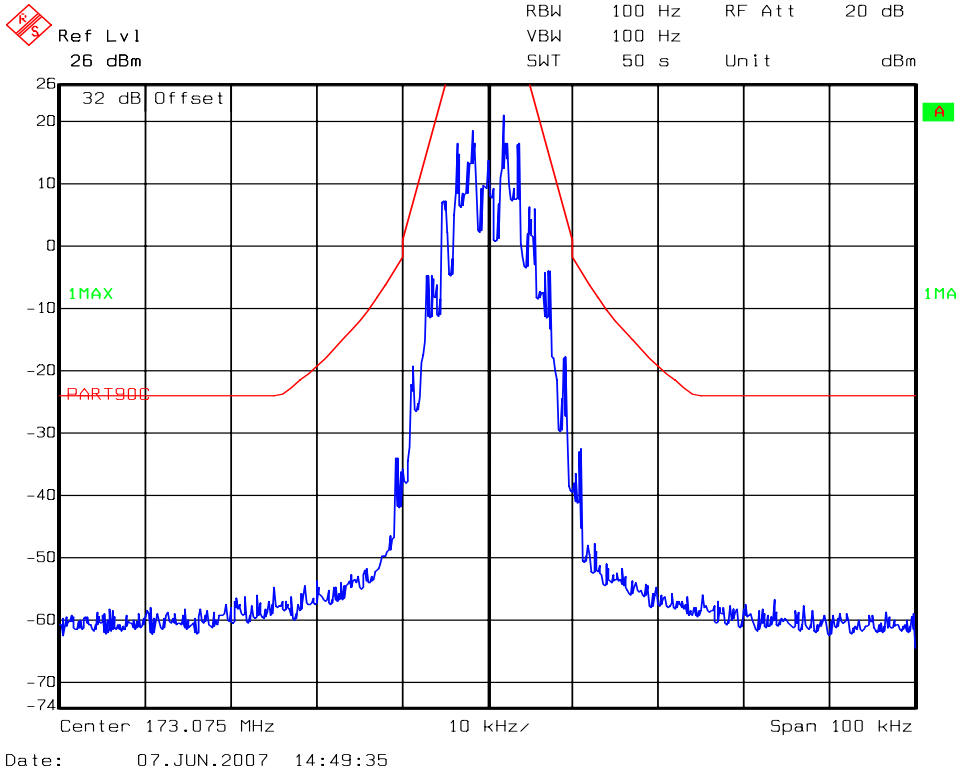
7.5. Transmitter Radiated Emissions Masks

The EUT was configured for transmitter radiated emissions measurements, as described in Section 9 of this report.

Tests were performed to determine compliance with the out of band power requirements at frequencies adjacent to the channel occupied by the fundamental frequency of the EUT.

Results:

Results are presented graphically in the following graphs. As can be seen from the plots that the EUT complies with the requirements of relevant part of the regulations.



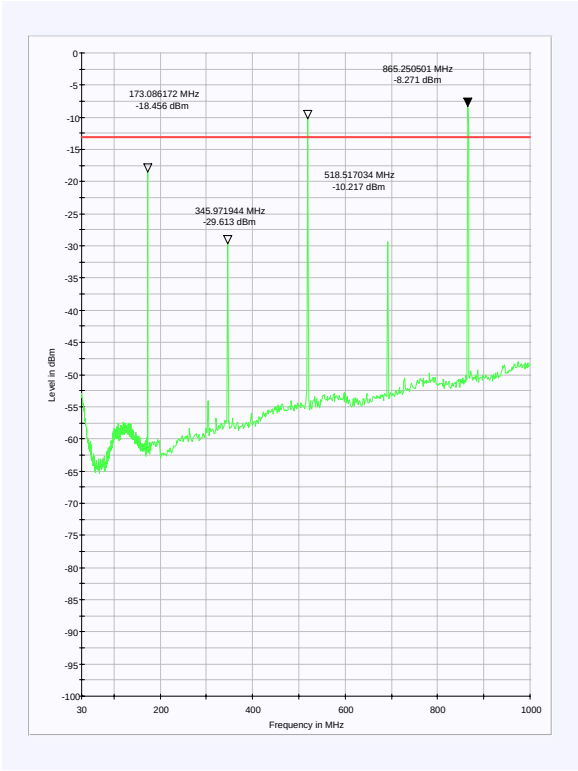
7.6. Transmitter Out of Band Radiated Emissions

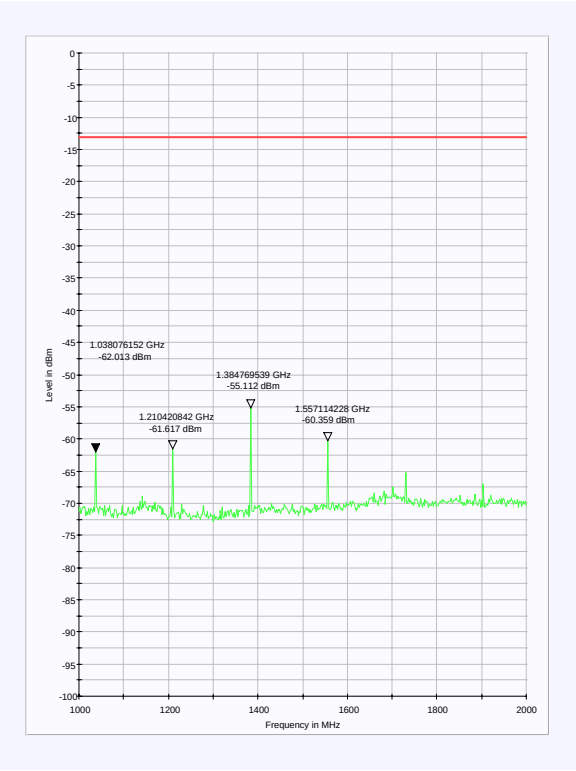
The EUT was configured for transmitter radiated emissions testing, as described in Section 9 of this report. Tests were performed to identify the maximum transmitter radiated emission levels.

Result:

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
519.219	-46.4	-13.0	33.4	Complied
692.316	-53.9	-13.0	40.9	Complied
865.364	-47.2	-13.0	34.2	Complied
1384.769	-55.1	-13.0	42.1	Complied
1557.114	-60.4	-13.0	47.4	Complied

Transmitter Out of Band Radiated Emissions (Continued)





7.7. Transmitter Frequency Stability (Temperature Variation)

Results:

Temperature (°C)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
-30	173.07499850	-1.50	-0.01	±5.0	4.99	Complied
-20	173.07483216	-167.84	-0.97	±5.0	4.03	Complied
-10	173.07489930	-100.70	-0.58	±5.0	4.42	Complied
0	173.07484619	-153.81	-0.89	±5.0	4.11	Complied
10	173.07483417	-165.83	-0.96	±5.0	4.04	Complied
20	173.07495240	-47.60	-0.28	±5.0	4.72	Complied
30	173.07499349	-6.51	-0.04	±5.0	4.96	Complied
40	173.07498848	-11.52	-0.07	±5.0	4.93	Complied
50	173.07490832	-91.68	-0.53	±5.0	4.47	Complied

7.8. Transmitter Frequency Stability (Voltage Variation)

Results:

Supply Voltage (V)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
3.1	173.07499248	7.52	-0.04	5.0	4.96	Complied
3.6	173.07499950	0.50	0.00	5.0	5.00	Complied
4.8	173.07499349	6.51	-0.04	5.0	4.96	Complied

7.9. Transmitter Transient Frequency Behaviour

Results:

Time Intervals	Frequency Difference (kHz)
	Single Channel
t1	20.8
t2	0.83
t3	24.9

Note(s):

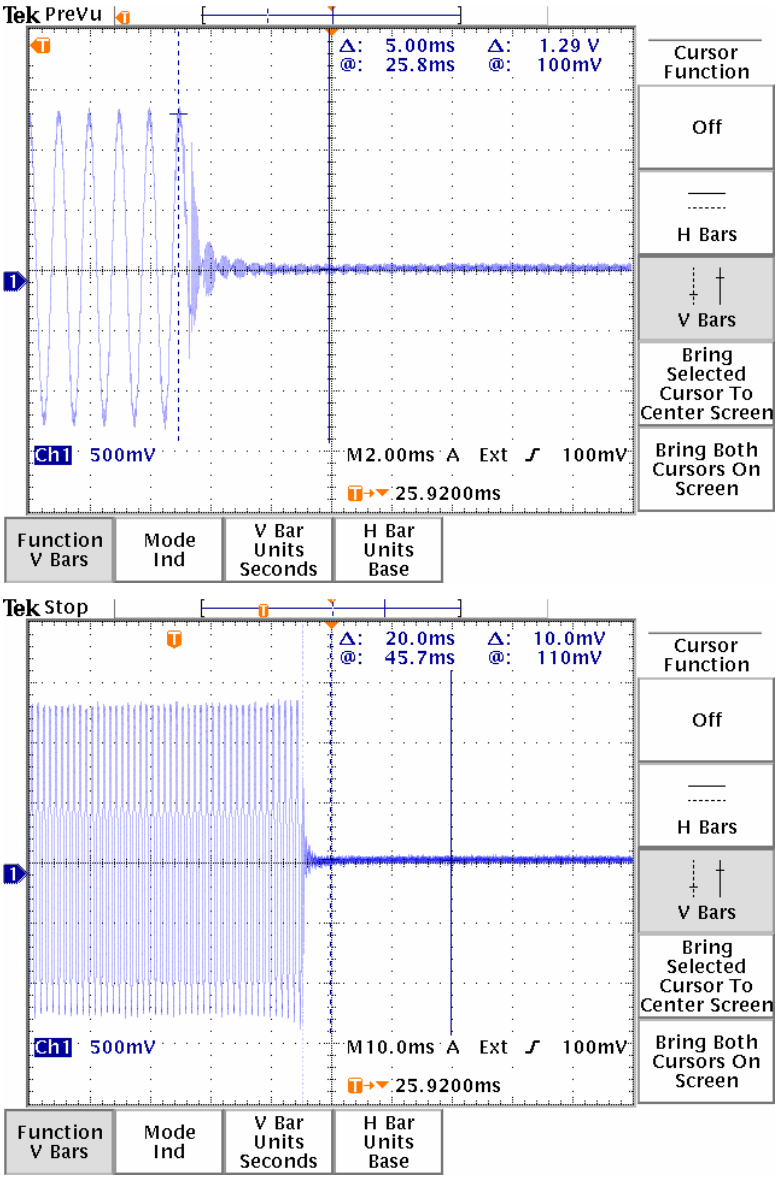
1. *All above frequency measurements were established within the measurement times specified.*

Limits:

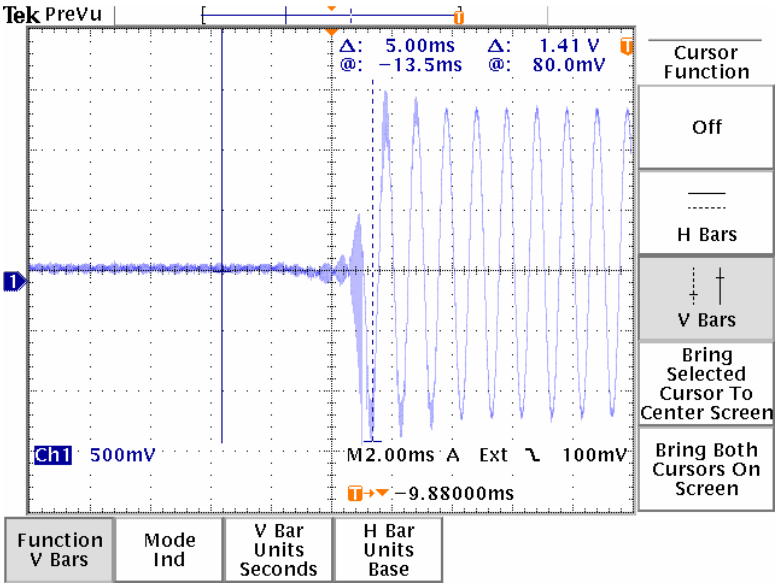
Time Intervals	Maximum Frequency Difference	Frequency Range
		150 to 174 MHz
t1	+/- 25.0 kHz	≤ 5.0 mS
t2	+/- 12.5 kHz	≤ 20.0 mS
t3	+/- 25.0 kHz	≤ 5.0 mS

Statement to confirm that during the period from the end of t2 to the beginning of t3, the frequency difference does not exceed 5 ppm (865 Hz) of the carrier frequency **YES**

Transmitter Transient Frequency Behaviour (Continued)



Transmitter Transient Frequency Behaviour (Continued)



7.10. Transmitter Duty Cycle: Section 90.20(e)(6)

7.10.1. The EUT was configured for duty cycle measurements, as described in Section 9 of this report.

7.10.2. Tests were performed to determine the transmission duration and the silent period time of the transmitter.

Operating Mode	Transmit Duration Time (milliseconds)	Limit (milliseconds)
Normal	185.8	≤ 200
Active Tracking	184.8	≤ 200

Operating Mode	Silent Period (seconds)	Limit (seconds)
Normal	21.878	≥ 9.8
Active Tracking	0.994	≥ 0.8

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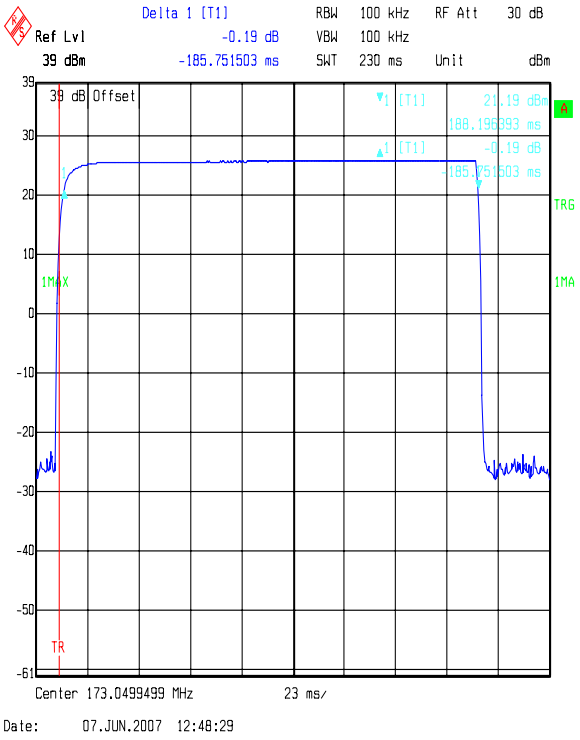
Transmitter Duty Cycle: Section 90.20(e)(6) (Continued)



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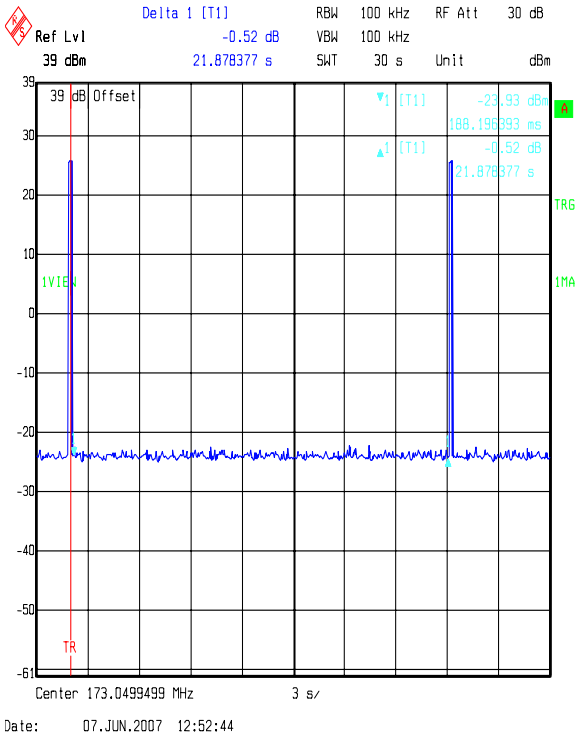

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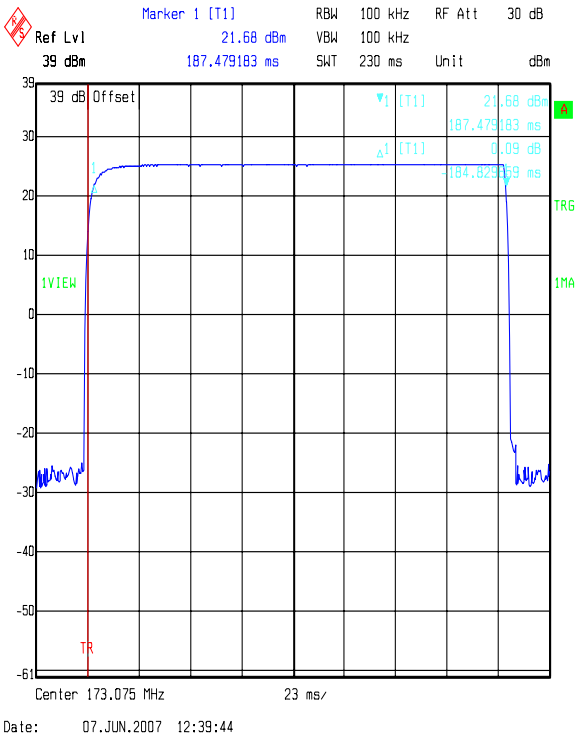

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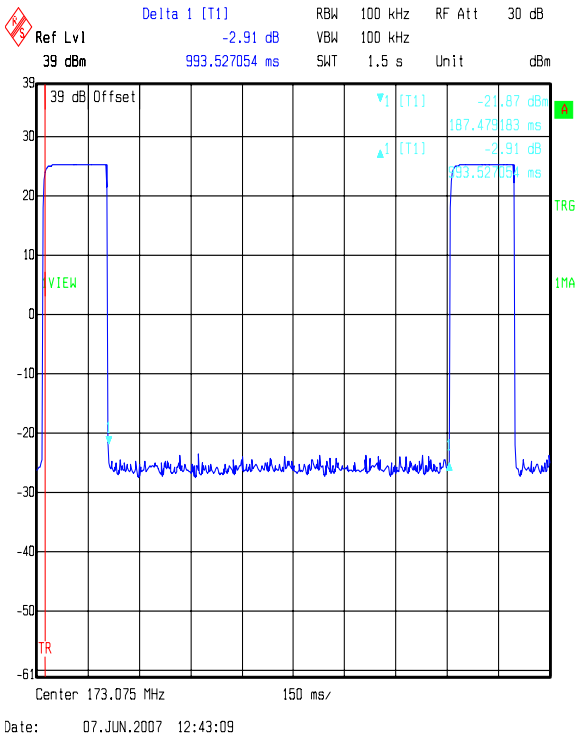


Date: 07.JUN.2007 12:43:09

8. Measurement Uncertainty

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	+/- 5.26 dB
Radiated Spurious Emissions	1 GHz to 2 GHz	95%	+/- 4.18 dB
Carrier Output Power (ERP)	30 MHz to 1000 MHz	95%	+/- 1.78 dB
Occupied Bandwidth	Not applicable	95%	+/- 0.12%
Frequency Stability	Not applicable	95%	+/- 20 Hz
Transient Frequency Behaviour	Not applicable	95%	+/- 10%
Duty Cycle	Not applicable	95%	+/- 10%

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.

9. Measurement Methods

9.1. Receiver Radiated Emissions

Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to the upper frequency detailed in Section 15.33(b) were performed within a screened chamber in order to identify frequencies on which the EUT was generating interference. This determined the frequencies from the EUT that required further examination. In order to minimise the time taken for the swept measurements, a peak detector was used in conjunction with the appropriate detector measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. A limit line was set to the specification limit. Levels within 20 dB of this limit were measured where possible, on occasion; the receiver noise floor came within the 20 dB boundary. On these occasions, the system noise floor may have been recorded.

An open area test site using the appropriate test distance and measuring receiver with a Quasi-Peak detector was used for measurements below 1000 MHz, for measurements above 1000 MHz average and peak detectors were used.

For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 - 2003 Clause 5.4.

On the open area test site, at each frequency where a signal was found, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m in the horizontal polarisation. At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT. The procedure was repeated for the vertical polarisation.

The final field strength was determined as the indicated level in dBμV plus cable loss and antenna factor.

Radiated Emissions (Continued)

The test equipment settings for radiated emissions measurements were as follows:

Receiver Function	**Initial Scan (Below 30 MHz)**	**Final Measurements (Below 30 MHz)**
Detector Type:	Peak	Quasi-Peak (CISPR) or Average
Mode:	Max Hold	Not applicable
Bandwidth:	200 Hz or 9 kHz	200 Hz or 9 kHz
Amplitude Range:	60 dB	20 dB
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

The test equipment settings for radiated emissions measurements were as follows:

Receiver Function	**Initial Scan**	**Final Measurements Below 1 GHz**	**Final Measurements Above 1 GHz**
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak/Average
Mode:	Max Hold	Not applicable	Not applicable
Bandwidth:	(120 kHz < 1 GHz) (1 MHz > 1 GHz)	120 kHz	1 MHz
Amplitude Range:	100 dB	100 dB	100 dB
Step Size:	Continuous sweep	Not applicable	Not applicable
Sweep Time:	Coupled	Not applicable	Not applicable

9.2. Transmitter Carrier Output Power (ERP)

The EUT and communications analyser were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

A communications analyser was connected to a receiving antenna and used to measure the field strength from the EUT. A signal substitution method was then used to measure the ERP of the device, radiated.

To determine the transmitter output power, the EUT was operated at maximum power.

9.3. Occupied (20 dB) Bandwidth

The EUT was connected to a spectrum analyser enabled with an occupied bandwidth function via an antenna test fixture.

Measurements were performed to determine the Occupied Bandwidth in accordance with FCC Part 2.1049. The Occupied Bandwidth was measured from the fundamental emission on the single transmit channel.

The Occupied Bandwidth was measured in line with the requirements of 2.1049 i.e. with the EUT modulated with a signal representing the maximum rated conditions under which it will operate (worst case)

The occupied bandwidth was measured using the built in occupied bandwidth function of the Rohde and Schwarz FSEB or ESIB spectrum analyser. It was set to measure the bandwidth where 99% of the signal power was contained. The analyser automatically configures the measurement bandwidths to make an accurate measurement based on the channel bandwidth and channel spacing of the EUT.

9.4. Transmitter Radiated Emissions

The EUT and spectrum analyser were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to 10 times the highest fundamental frequency were performed in order to identify frequencies on which the EUT was generating spurious emissions. This determined the frequencies from the EUT that required further examination. Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m, below 4 GHz; above 4 GHz a 1 m measurement distance was used. A limit line was set to the specification limit. Levels within 20 dB of this limit were measured where possible, on occasion; the receiver noise floor came within the 20 dB boundary. On these occasions, the system noise floor may have been recorded.

For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2003 Clause 5.4.

An open area test site using the appropriate test distance and spectrum analyser with an peak detector was used for final measurements. All measurements on the open area test site were performed using broadband antennas.

On the open area test site, at each frequency where a signal was found, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m in the horizontal polarisation. At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT. The procedure was repeated for the vertical polarisation.

Once the final amplitude (maximised) had been obtained and noted, the EUT was replaced by a substitution antenna, and a substitution method applied. The substitution antennas used were a horn antenna for measurements greater then or equal to 1 GHz and a dipole for measurements below 1 GHz. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT frequency under test.

The test antenna was then raised and lowered to obtain a maximum reading on the spectrum analyser. The level of the signal generator output was then adjusted until the maximum recorded EUT level was observed. The signal generator level was noted. This procedure was repeated with both test antenna and substitution antenna vertically polarised. The EIRP was calculated as:-

ERP = Signal Generator Level - Cable Loss + Antenna Gain

Once the ERP was obtained, the difference between it and the level of the fundamental emission for the ERP of the channel under test was noted at the spurious attenuation level in dBc. The following formula was used as described in TIA-603-B.

$$dB = 10 \log_{10} \left(\frac{TX \text{ power in watts}}{0.001} \right) - \text{spurious level (dBm)}$$

Transmitter Radiated Emissions (Continued)

For frequencies further than 12.5 kHz from the centre of the authorised bandwidth (fc) the emissions shall be attenuated by at least 50 + 10 log (P *in Watts*) dB or 70 dB (whichever is the lesser attenuation) relative to the transmitter output power level measured for the channel under test. The tabulated results in the results section of this report show the spurious emission in dBm and as attenuation relative to the carrier in dBc.

For the frequency ranges close to and including the fundamental frequency, plots of the spectral distribution (emission masks) were recorded using a spectrum analyser for the EUT transmitting on bottom, middle and top channels. The method used was in accordance with the methods detailed in FCC Part 90.210.

FCC Part 90.210 states the appropriate emission mask that shall be used for a given channel bandwidth. Measurements were performed using the appropriate emission mask for the channel bandwidth declared i.e. Emission Mask D for a channel bandwidth of 12.5 kHz.

Receiver Function	**Settings**
Detector Type:	Peak
Mode:	Max Hold
Bandwidth:	As per Part 90.210 <50 kHz away from fc
Bandwidth:	1 MHz >1 GHz
Bandwidth:	10 kHz <1 GHz
Amplitude Range:	100 dB
Sweep Time:	Coupled

9.5. Transmitter Frequency Stability

The EUT and communications analyser were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

The EUT was situated within an environmental test chamber and monitored on the communications analyser via an antenna test fixture.

Measurements were performed with the EUT operating under extremes of temperature in 10 degree increments within the range -30°C to +50°C.

Measurements were also performed at voltage extremes between the declared nominal supply voltage and at the declared endpoint voltage (for hand carried battery operated equipment) or by varying the primary supply voltage from 85% to 115% of the nominal value for all other equipment types.

The requirement was to determine the frequency stability of the device under specified environmental operating conditions.

The EUT was switched off for a minimum of 30 minutes between each stage of testing while the environmental chamber stabilised at the next temperature within the stated temperature range.

Once the environmental chamber had reached thermal equilibrium, the nominal frequency of the EUT was measured and recorded. The recorded frequency was compared to the declared nominal operating frequency of the channel being tested.

The frequency error measured was converted to an error in ppm using the following formula as defined by TIA_EIA_603A :-

$$\text{ppm error} = \left(\frac{MCF_{MHz}}{ACF_{MHz}} - 1\right) * 10^6$$

where MCF_{MHz} is the measured carrier frequency in MHz
ACF_{MHz} is the assigned carrier frequency in MHz

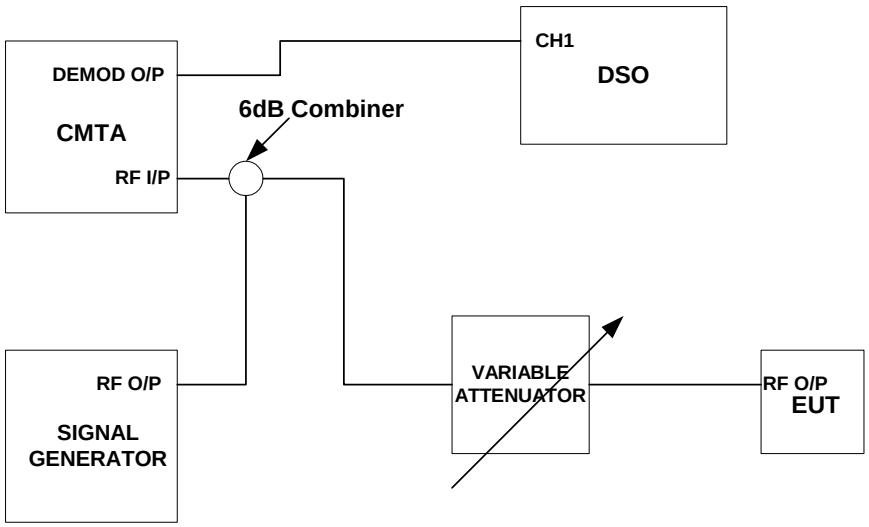
The measured ppm had to be less then the relevant limits in order to comply.

9.6. Transmitter Transient Frequency Behaviour

The EUT and test equipment were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

The EUT was connected to a communications analyser in the configuration shown in Figure 1 below.

Figure 1



The test equipment settings were as follows:

Oscilloscope Function	Settings
Coupling:	DC
Sweep Time:	10ms/Division
Trigger Mode:	Normal
Attack Trigger Position:	1/8th Pre-trigger
Release Trigger Position	7/8th Pre-trigger
Trigger Slope:	+ or – dependant on whether attack or release

CMTA Test Receiver Function	Settings
Centre Frequency (Set)	EUT's Nominal Frequency
Channel Spacing:	12.5 kHz
Special Function:	SPEC 72 (CMTA Squelch disable)

Signal Generator Function	Settings
Centre Frequency:	EUT's Nominal Frequency
Amplitude:	30 dB down on EUT's carrier power at the combiner
Audio Frequency:	1 kHz
FM Deviation	12.5 kHz

Transmitter Duty Cycle

9.6.1. The EUT and spectrum analyser was configured as for transmitter radiated emissions measurements.

9.6.2. To determine the transmission duration and silent period time of the transmitter, a spectrum analyser was set to the transmitter carrier frequency with its Resolution Bandwidth (RBW) set wide enough to encompass all significant spectral components, an RBW of 100 kHz was used. The Video Bandwidth was set to 100 kHz.
The frequency span was set to 0 Hz.

9.6.3. The sweep time was set to a period long enough to capture the entire Transmit On Time pulse. The Transmit On Time pulse width was measured and a plot taken.

9.6.4. In order to measure the silent period, the sweep time was then extended to cover a suitable period.

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A028	Horn Antenna	Eaton	91888-2	304	08 Jun 2006	36
A046	High Pass Filter	Aerial Facilities	HP-250-5N	4014B	Cal before use	-
A059	Log Periodic Antenna	EMCO	3146	8902-2378	17 Nov 2006	12
A091	Biconical Antenna	EMCO	3110	9008-1182	09 Jun 2006	12
A1276	Attenuator	suhner	12345	001	Cal before use	-
A1397	Attenuator	Weinschel	WA46-20	A128	Cal before use	-
A227	Power Divider	Suhner	4901/01/A	none	Cal before use	-
A288	Bilog Antenna	Chase	CBL6111A	1589	Cal as system	-
C055	Cable	RFI	None	None	05 Jun 2007	12
C1065	Cable	Rosenberger	UFA210-1-7872	0985	06 Jun 2007	12
C1181	Cable	RS Component	284-3792	0	Cal before use	-
C151	Cable	Rosenberger	UFA210A-1-1181-70x70	None	Cal before use	-
C160	Cable	Rosenberger	UFA210A-1-1181-70x70	None	Cal before use	-
C348	Cable	Rosenberger	UFA210A-1-1181-70x70	2993	Cal before use	-
C433	Cable	Not stated	Not stated	Not stated	Cal before use	-
C536	Cable	Rosenberger	RG223	N/A	Cal before use	-
E013	Thermal Chamber	Sanyo	ATMOS	None	Not calibrated	-
G048	Signal Generator	R&S	SMY 01	841 104/032	13 Jun 2006	12

Test Equipment (Continued)

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
M015	CMTA Radio Test Set	R&S	CMTA	883 574/003	23 Feb 2007	12
M1068	Thermometer Digital	Iso-Tech	RS55	93102884	09 Jun 2006	12
M1242	Spectrum Analyser	R&S	FSEM30	845986_02 2	08 Sep 2006	12
M1263	EMI Test Receiver	R&S	ESIB7	100265	25 Jun 2006	12
M1269	Multimeter	Fluke	179	90250210	05 Mar 2007	12
M127	Spectrum Analyser	R&S	FSEB 30	842 659/016	07 Aug 2006	12
M1368	Oscilloscope	Tektronix	B040692	TDS3054B	31 May 2007	12
S004	High Pass Filter	Farnell	L30/5	None	Cal before use	-
S009	DC PSU	Farnell	PDD3502A	174	Cal before use	-
S202	3m OATS	RFI	2	S202-15011990	17 Nov 2006	12
S207	PMR Bench Site	RFI	7	None	Not calibrated	-
S212	Emissions Screened Room	RFI	12	None	Not calibrated	-

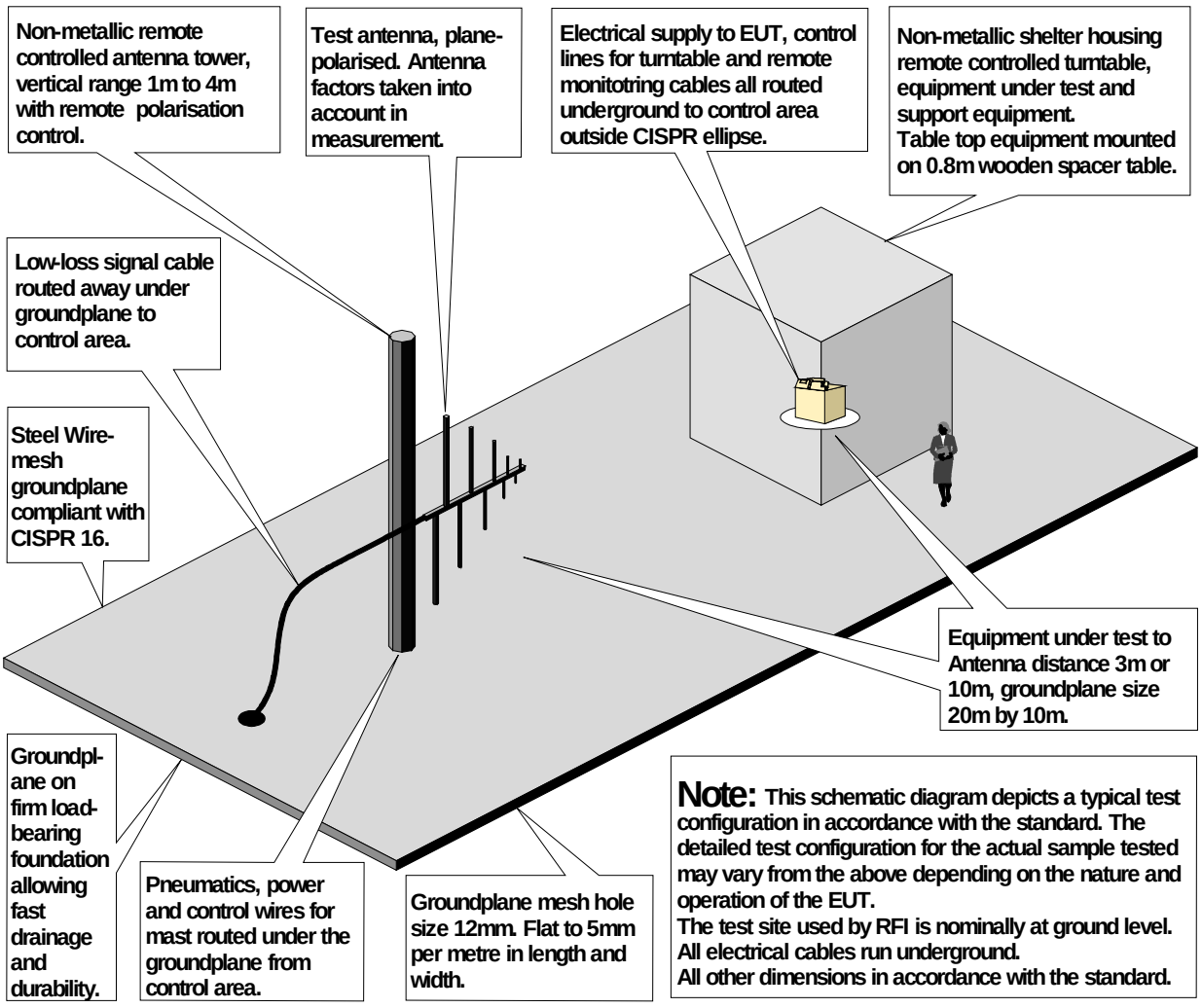
NB In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.

Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\49278JD01\EMIRAD	Test configuration for measurement of radiated emissions.

DRG\49278JD01\EMIRAD



Note: This schematic diagram depicts a typical test configuration in accordance with the standard. The detailed test configuration for the actual sample tested may vary from the above depending on the nature and operation of the EUT.
The test site used by RFI is nominally at ground level.
All electrical cables run underground.
All other dimensions in accordance with the standard.

Test Configuration For Radiated Emissions Measurements

Reflection-free area: >60m by 52m (CISPR ellipse)
Groundplane Earthed
Control room outside CISPR ellipse