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Report On

FCC Testing of the
Cobham Tactical Communications Inca Repeater
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 90

COMMERCIAL-IN-CONFIDENCE

FCC ID: QKE-90136040

Document 75925939 Report 02 Issue 2 July 2014

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REPORT ON FCC Testing of the
Cobham Tactical Communications Inca Repeater
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 90

Document 75925939 Report 02 Issue 2

July 2014

PREPARED FOR Cobham Tactical Communications
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APPROVED BY

Ryan Henley
Authorised Signatory

DATED 03 July 2014

This report has been up-issued to Issue 2 to include the FCC ID.

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 2 and FCC CFR 47 Part 90. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

Matthew Russell Andrew Galpin Tony Guy Stephen Milliken

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Product Service

SECTION 1

REPORT SUMMARY

FCC Testing of the
Cobham Tactical Communications Inca Repeater
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 90

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the FCC Testing of the Cobham Tactical Communications Inca Repeater to the requirements of FCC CFR 47 Part 2 and FCC CFR 47 Part 90.

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	Cobham Tactical Communications
Model Number(s)	Inca Repeater
Serial Number(s)	891050
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 2 (2013) FCC CFR 47 Part 90 (2013)
Incoming Release Date	Application Form 26 March 2014
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	23561-3 19 February 2014
Start of Test	26 February 2014
Finish of Test	21 March 2014
Name of Engineer(s)	M Russell T Guy A Galpin S Milliken
Related Document(s)	ANSI C63.4: 2009 KDB 971168 D01 v02 r01

Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 90 is shown below.

Section	Spec Clause		Test Description	Result	Comments/Base Standard
	Pt 2	Pt 90			
Transmit					
2.1	2.1046	90.205	Effective Radiated Power	Pass	
2.2	2.1047	90.207	Type of Emissions	Pass	
2.3	2.1049	90.209	Bandwidth Limitations	Pass	
2.4	2.1051	90.210	Emission Mask	Pass	
2.5	2.1046	90.210	Power and Antenna Height Limits	Pass	
2.6	2.1055	90.213	Frequency Stability	Pass	
2.7	-	90.214	Transient Frequency Behaviour	Pass	

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1.3 APPLICATION FORM

APPLICANT'S DETAILS

COMPANY NAME : Cobham Spectronic A/S
ADDRESS : Skindbjerg Vej 44.....
DK- 8500 Grenaa.....
Denmark.....
NAME FOR CONTACT PURPOSES : ..Lars Julsgaard.....

TELEPHONE NO: ...+45 87918122..... FAX NO: +45 87918181.....
E-MAIL: Lars.Julsgaard@cobham.com.....

EQUIPMENT INFORMATION

Model name/number Inca Repeater... Identification/Part number 90136041.....
Hardware Version .....0202..... Software Version ...1.0.2.....
Manufacturer Cobham Spectronic A/S Country of Origin Denmark.....
FCC ID ..... Industry Canada ID .....
Technical description (a brief description of the intended use and operation)
Transmitter with repeater functionality operating in the VHF band – to be operated by professionals.

Supply Voltage:
[ ] AC mains State AC voltage ..... V and AC frequency ..... Hz
[X] DC (external) State DC voltage ...12 V and DC current .....2,5 . A
[ ] DC (internal) State DC voltage ..... V and Battery type .....

Frequency characteristics:
Transmitter Frequency range .....150. MHz to ...174 MHz Channel spacing ...12,5kHz.....
(if channelized)
Receiver Frequency range .....to ... Channel spacing .....
(if different) (if channelized)
Designated test frequencies:
Bottom: .....150..... MHz Middle: .....158 MHz Top: .....174 MHz
Intermediate Frequencies : ..... MHz
Highest Internally Generated Frequency : ..... MHz

Power characteristics:
Maximum transmitter power .....5 W Minimum transmitter power .....0,320 W
(if variable)
[X] Continuous transmission
[ ] Intermittent transmission State duty cycle .....
If intermittent, can transmitter be set to continuous transmit test mode? Y/N

Antenna characteristics:
[BNC] Antenna connector State impedance .....50 ohm
[ ] Temporary antenna connector State impedance ..... ohm
[ ] Integral antenna Type ..... State gain ..... dBi
[ ] External Antenna Type ..... State gain .....0... dBi

Modulation characteristics:
[ ] Amplitude [ ] Other
[X] Frequency Details: ...FM.....
[ ] Phase (GMSK, QSPK etc)
Can the transmitter operate un-modulated? Y
ITU Class of emission: .....

Battery/Power Supply
Model name/number ..... Identification/Part number .....
Manufacturer ..... Country of Origin .....

Ancillaries (if applicable)
Model name/number ..... Identification/Part number .....
Manufacturer ..... Country of Origin .....

Extreme conditions:
Maximum temperature .....55... °C Minimum temperature .....0 °C
Maximum supply voltage .....15,6 V Minimum supply voltage .....10,0 V

Product Service

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature: 

Name : Lars Julsgaard

Position held : Engineering Manager - HW & Partnering

Date : 26-03-2014

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Cobham Tactical Communications Inca Repeater. 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 12 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 State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: IMEI 004401115077063			
0	As supplied by manufacturer.	N/A	N/A
1	Software only modification adding shutdown functionality to the RF bias circuitry. This included implementation of 1 pin on microprocessor board. See manufacturer's technical documentation for further details.	Lars Julsgaard	10 March 2014

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.

SECTION 2

TEST DETAILS

FCC Testing of the
Cobham Tactical Communications Inca Repeater
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 90

2.1 EFFECTIVE RADIATED POWER

2.1.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1046
FCC CFR 47 Part 90, Clause 90.205

2.1.2 Equipment Under Test and Modification State

Inca Repeater S/N: 891050 - Modification State 0

2.1.3 Date of Test

21 March 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

Measurements of the fundamental from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The fundamental frequency was maximised by adjusting the antenna height, antenna polarisation and turntable azimuth. A peak detector was used with the trace set to max hold. The maximum result was recorded.

The EUT was then removed from the chamber and replaced with a substitution antenna. Using a signal generator the level was adjusted to achieve the same value on the measuring instrument as previously recorded with the EUT. The final result (ERP) was determined by a calculation using the signal generator level, antenna gain and cable loss.

The measurements were performed at a 3m distance unless otherwise stated.

2.1.6 Environmental Conditions

Ambient Temperature	21.5°C
Relative Humidity	35.0%

2.1.7 Test Results

12 V DC Supply

Frequency	Result (dBm)	Result (W)
150.0	33.90	2.454
158.0	34.08	2.558
174.0	33.49	2.233

Limit

	Service area radius (km)
	8
Maximum ERP (w)	28
Up to reference HAAT (m)	15

2.2 TYPE OF EMISSIONS

2.2.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1047
FCC CFR 47 Part 90, Clause 90.207

2.2.2 Equipment Under Test and Modification State

Inca Repeater S/N: 891050- Modification State 0

2.2.3 Date of Test

26 February 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

This test was carried out in accordance with Part 2.1047 (a) (b) (c) (1).

The EUT was connected to a modulation analyser via a sensor, cable and attenuator. The EUT was configured to transmit at maximum power on the middle channel. The audio input was initially set at a level of 100 mV and the audio frequency varied between 100 Hz and 5 kHz to show the audio response in the non-saturated region. The input level was then increased by 16 dB and the audio frequency again varied between 100 Hz and 5 kHz and finally repeated again increased by a further 16 dB to show the EUT's capability to limit the level of modulation for different input signal levels and frequencies. The results are shown on the graph below.

The level of the audio input for all other tests was established by finding the frequency which resulted in the peak audio response as shown by the graph below. The level was then decreased to 50% of the manufacturers rated modulation and the frequency of the audio signal adjusted to 2.5 kHz. An FSQ spectrum analyser was used to show the demodulated signal from the EUT.

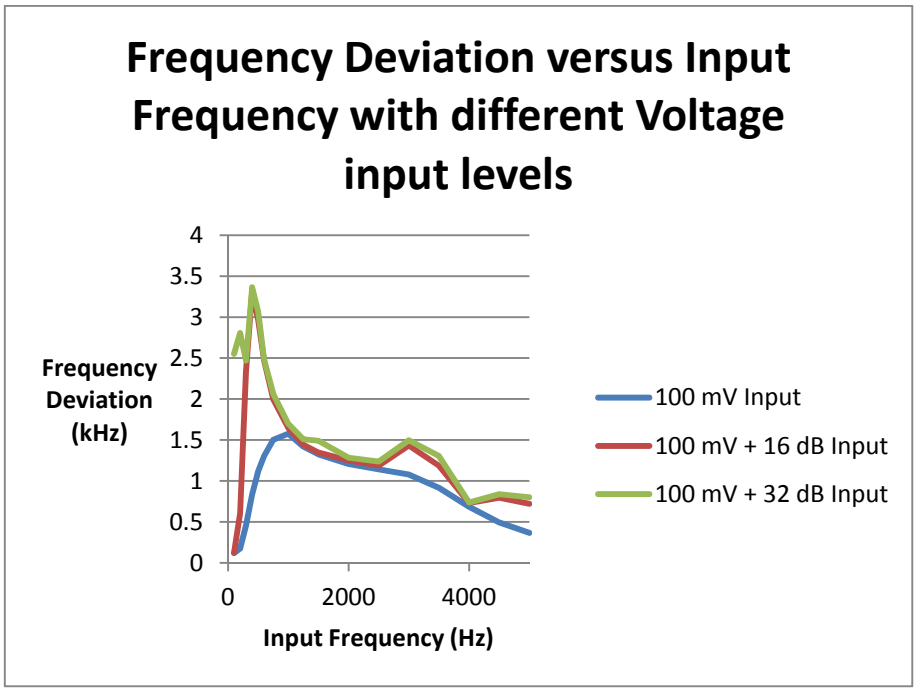
2.2.6 Environmental Conditions

Ambient Temperature	23.7°C
Relative Humidity	25.4%

Product Service

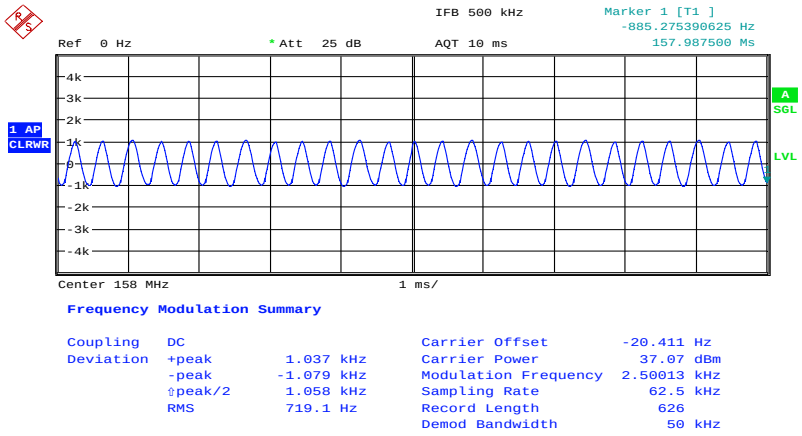
2.2.7 Test Results

12 V DC Supply



The class of the emission has been declared as F3E and has been authorised for use in accordance with 90.207.

The above graph shows a maximum audio frequency response, with an input level of 100 mV + 16 dB, at approximately 400 Hz. With the audio frequency set to 400 Hz, the input level was reduced to give a deviation of 1.5 kHz (50% of the manufacturers rated maximum response). The input level was then increased by 16 dB and the audio frequency set to 2.5 kHz. This signal was used as the modulating input for all tests unless otherwise stated in the test section. The plot below shows the demodulated signal from the EUT using an FSQ spectrum analyser.



Limit

(a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

(b) Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

(c) (1) Other than single sideband or independent sideband transmitters - when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.

2.3 BANDWIDTH LIMITATIONS

2.3.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049
FCC CFR 47 Part 90, Clause 90.209

2.3.2 Equipment Under Test and Modification State

Inca Repeater S/N: 891050- Modification State 0

2.3.3 Date of Test

26 February 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

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 90.209 (b), Part 2.1049 (c) (1) and KDB 971168.

The EUT was transmitting at maximum power, modulated by a 2500 Hz tone at an input level 16 dB greater than the level required which produced 50% modulation. The EUT was connected to a spectrum analyser via a cable and attenuator, the RBW of the spectrum analyser was set to 100 Hz and a video bandwidth of 300 Hz, the occupied bandwidth measurement function of the analyser was used and the 99% bandwidth recorded.

The plots on the following pages show the resultant display from the Spectrum Analyser.

2.3.6 Environmental Conditions

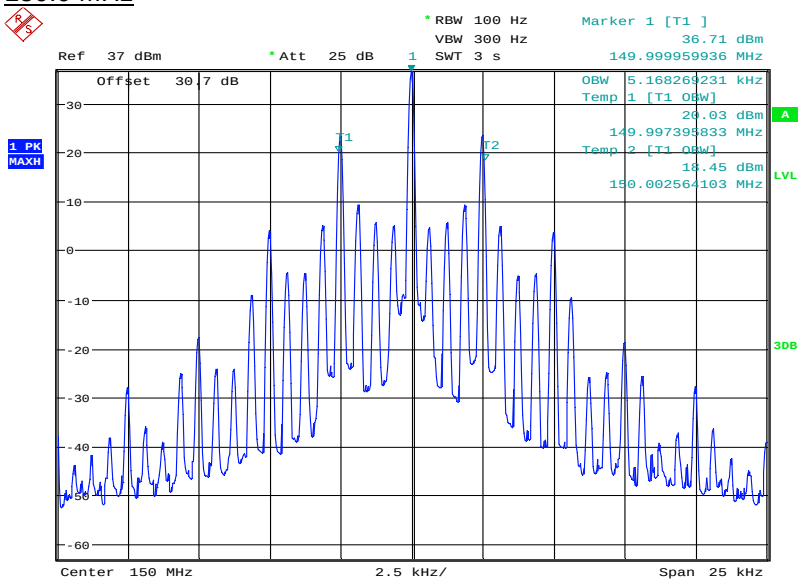
Ambient Temperature	23.6°C
Relative Humidity	26.1%

2.3.7 Test Results

12 V DC Supply

Frequency	Occupied Bandwidth (kHz)
150.0 MHz	5.168
158.0 MHz	5.168
174.0 MHz	5.168

150.0 MHz



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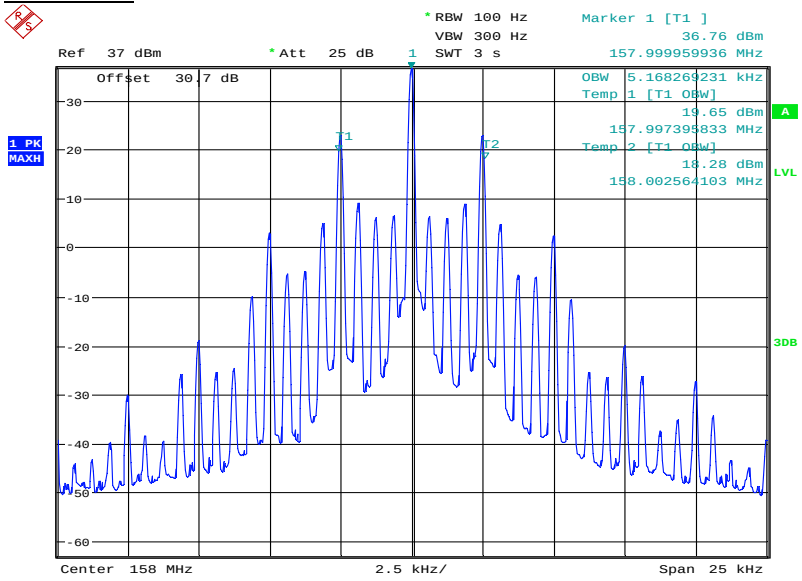
158.0 MHz



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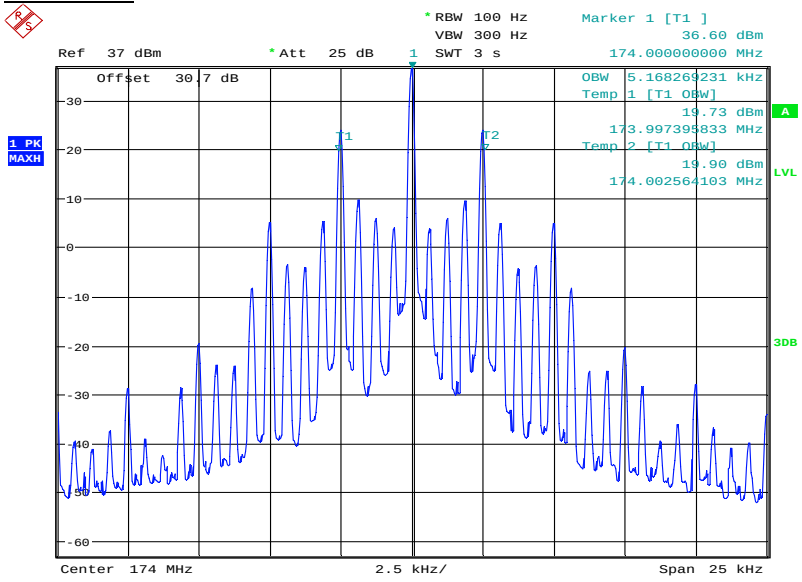
174.0 MHz



Date: 26.FEB.2014 14:34:10

Limit

Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth.

All stations must operate on channels with a bandwidth of 12.5 kHz or less beginning January 1, 2013, unless the operations meet the efficiency standard of § 90.203(j)(3).

2.4 EMISSION MASK

2.4.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 90, Clause 90.210

2.4.2 Equipment Under Test and Modification State

Inca Repeater S/N: 891050- Modification State 1

2.4.3 Date of Test

11 and 21 March 2014

2.4.4 Test Equipment Used

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

2.4.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 90.210 (d) and Part 2.1049 (c) (1).

For emissions less than 50 kHz removed from the edge of the authorized bandwidth measurements were performed conducted as follows:

The EUT was connected to a spectrum analyser via a cable and attenuator. The EUT was transmitting at maximum power, for bottom, middle and top channels. The EUT was modulated using a 2500 Hz audio tone at an input level 16 dB greater than that required to produce 1.5 kHz frequency deviation at 400 Hz. This was determined at the frequency which resulted in the maximum response of the audio modulating circuit. The path loss between the EUT and analyser was calibrated using a network analyser and entered in to the spectrum analyser as a reference level offset. The reference level for the mask was established with an RBW of 30 kHz and VBW of 100 kHz. The RBW and VBW were then reduced to 100 Hz and 300 Hz respectfully and Emission Mask (d) was then applied. Where the emission was within 3 dB of the limit, a zoomed in plot has been provided to give further clarification that the EUT satisfies the requirements.

For emissions greater than 50 kHz removed from the edge of the authorized bandwidth, measurements were performed both conducted and radiated as follows:

Conducted: A network analyser was used to measure the path loss and the worst case was entered as a reference level offset in to the spectrum analyser. The EUT was connected to a spectrum analyser via an attenuator, filter and cable. Between 9 kHz and 200 MHz just the attenuator was used, between 200 MHz and 300 MHz a notch filter was used tuned to the frequency of the fundamental in addition to the attenuator. Between 300 MHz and 2 GHz a 300 MHz high pass filter was used alongside the attenuator. The EUT was configured to maximum power on bottom, middle or top channel. The spectrum analyser was configured with an RBW of 100 kHz below 1 GHz and 1 MHz for frequencies greater than 1 GHz with the trace set to max hold using a peak detector.

Radiated; A preliminary profile of the Spurious Radiated Emissions was obtained up to the 10th harmonic by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, the list of emissions was then confirmed or updated under Alternative Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

The EUT was set to transmit on maximum power on the bottom, middle and top channels.

For any emissions found the EUT was then removed from the chamber and replaced with a substitution antenna. Using a signal generator the level was adjusted to achieve the same value on the measuring instrument as previously recorded with the EUT. The final result was determined by a calculation using the signal generator level, antenna gain and cable loss.

The measurements were performed at a 3m distance unless otherwise stated.

2.4.6 Environmental Conditions

Ambient Temperature	23.6°C
Relative Humidity	30.9%

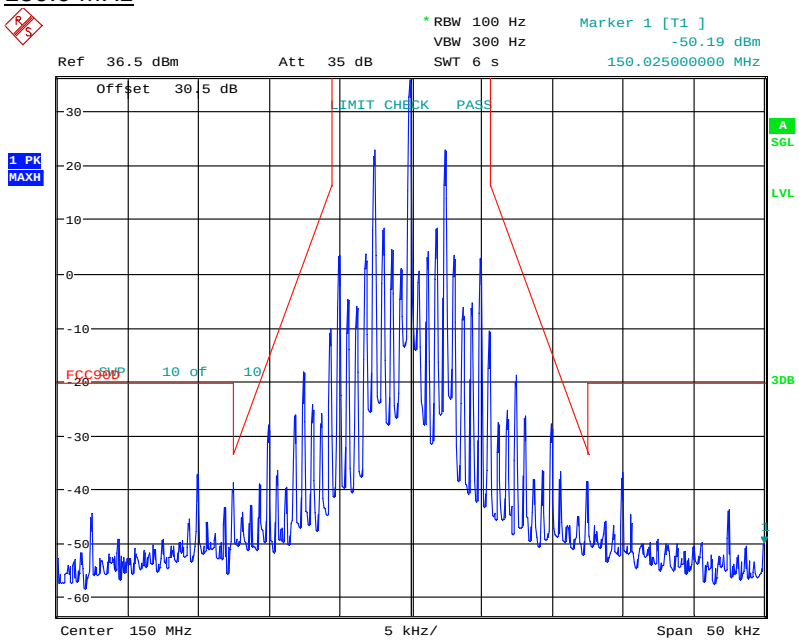
Product Service

2.4.7 Test Results

12 V DC Supply

Conducted

150.0 MHz



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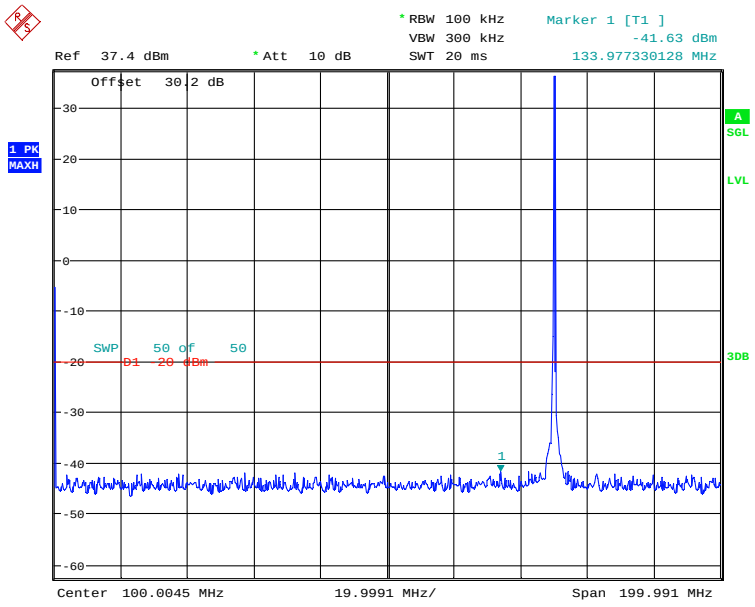
Product Service

9 kHz to 200 MHz



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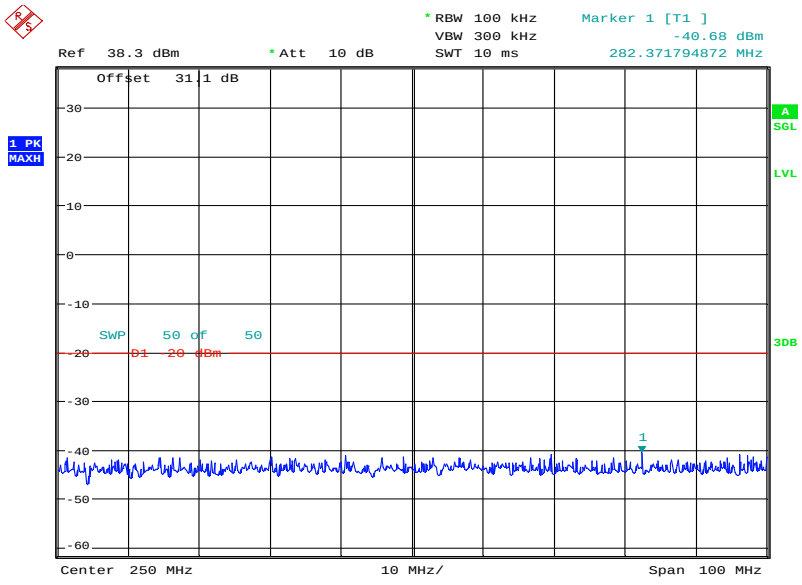
200 MHz to 300 MHz



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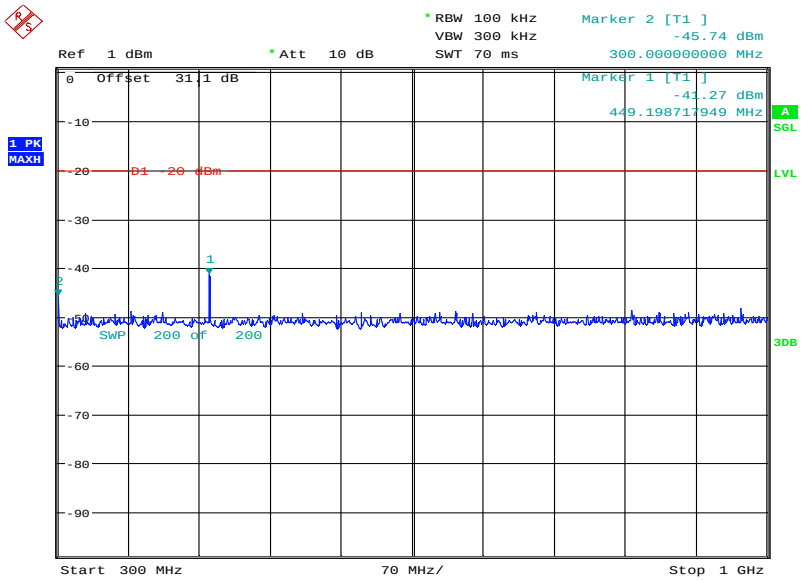
Product Service

300 MHz to 1 GHz



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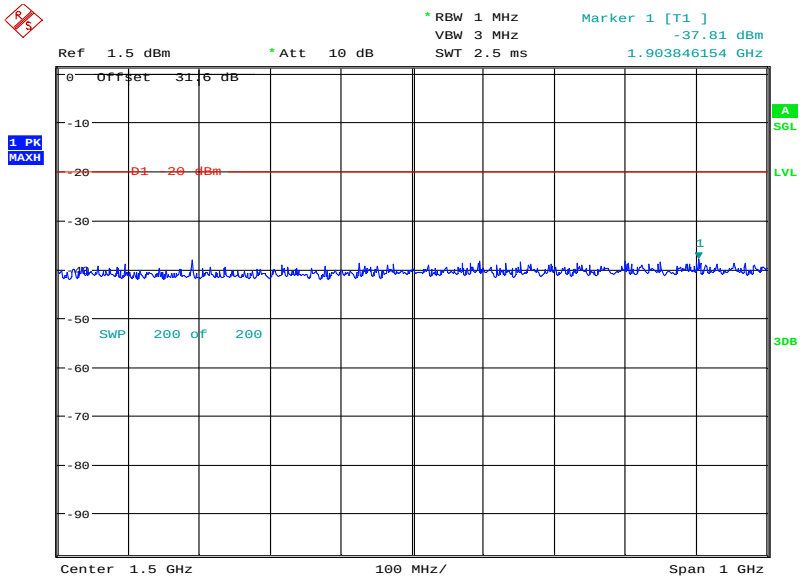
1 GHz to 2 GHz



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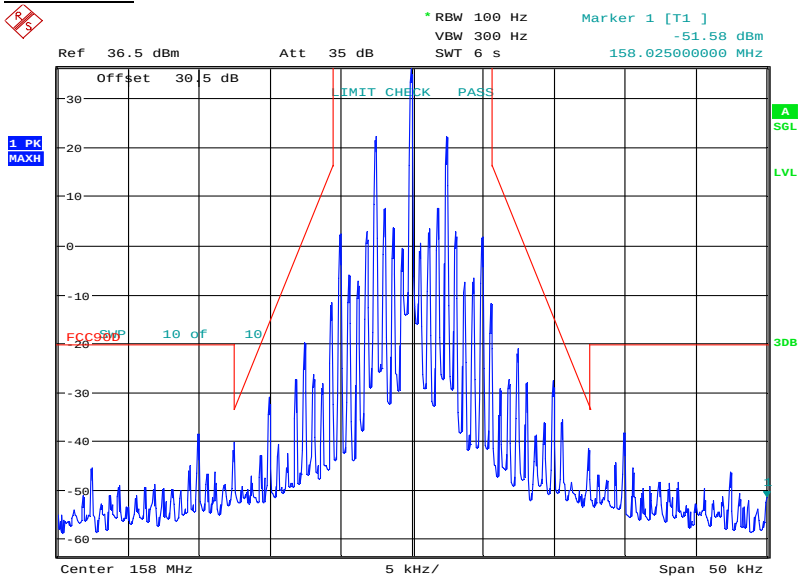
158.0 MHz



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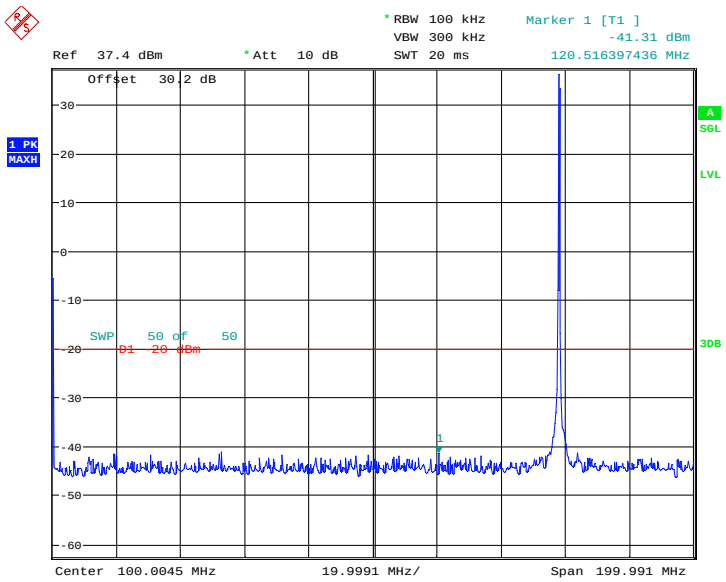
9 kHz to 200 MHz



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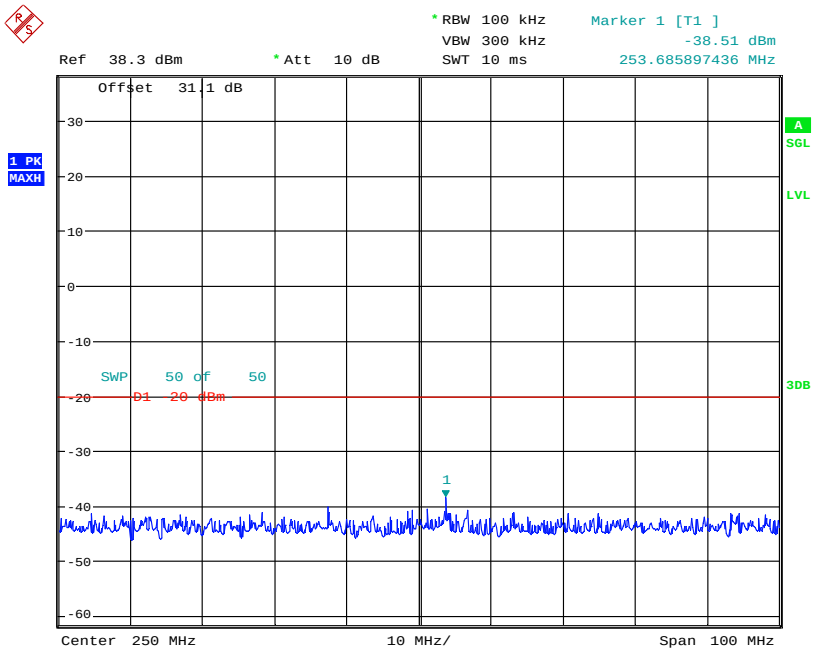
200 MHz to 300 MHz



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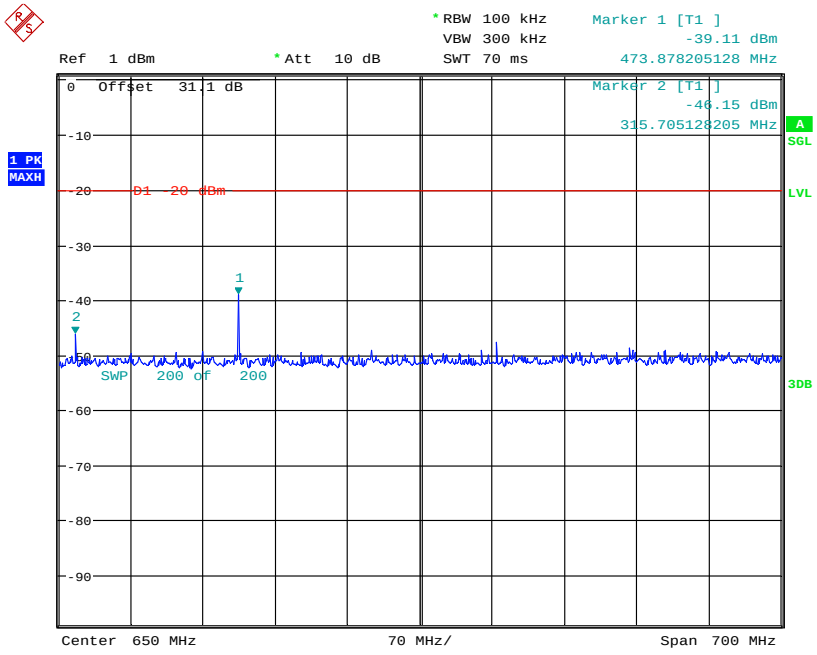
300 MHz to 1 GHz



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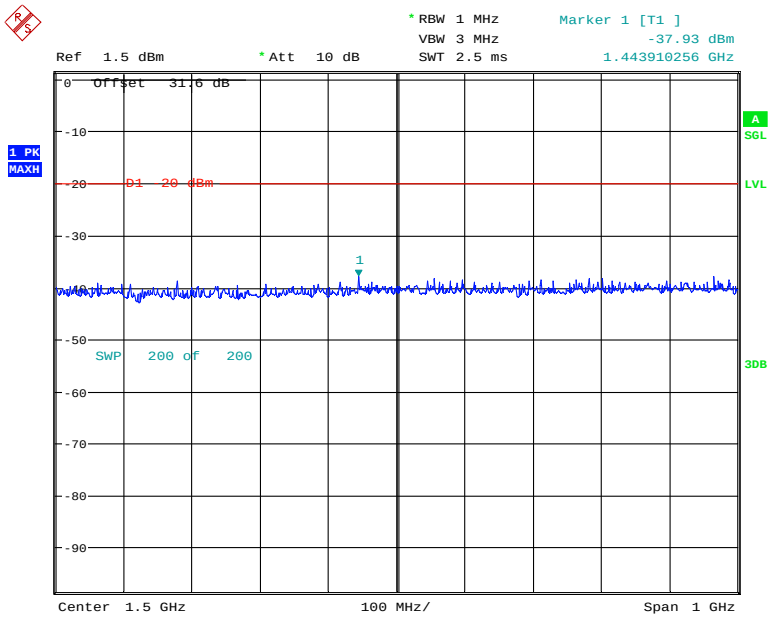
Product Service

1 GHz to 2 GHz



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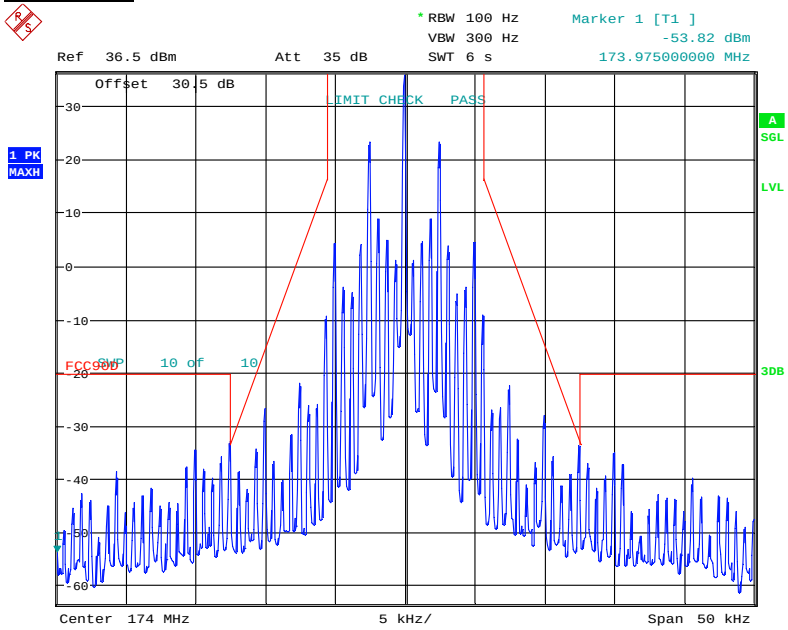
174.0 MHz



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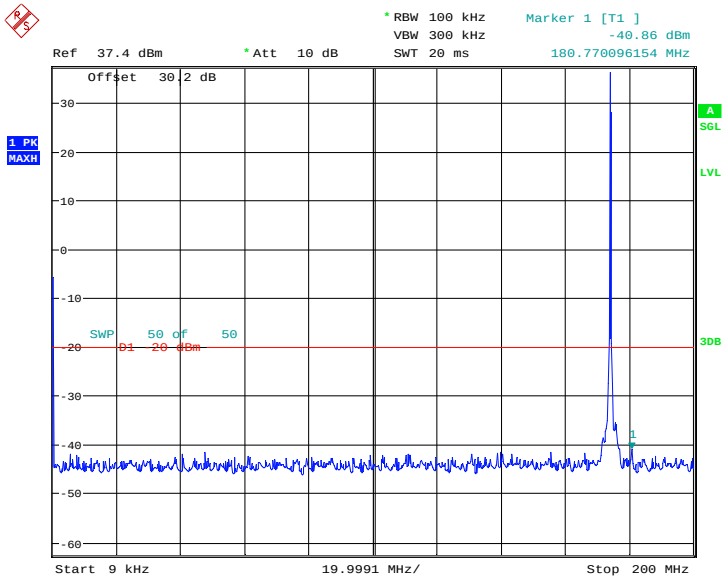
Product Service

9 kHz to 200 MHz



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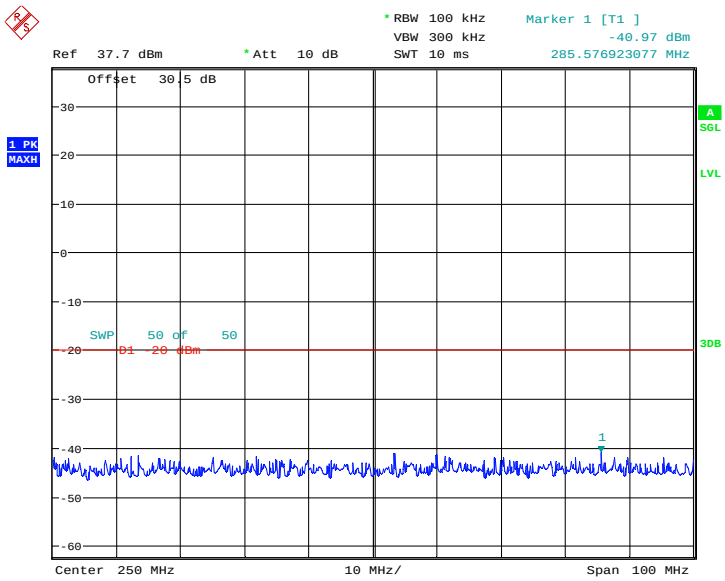
200 MHz to 300 MHz



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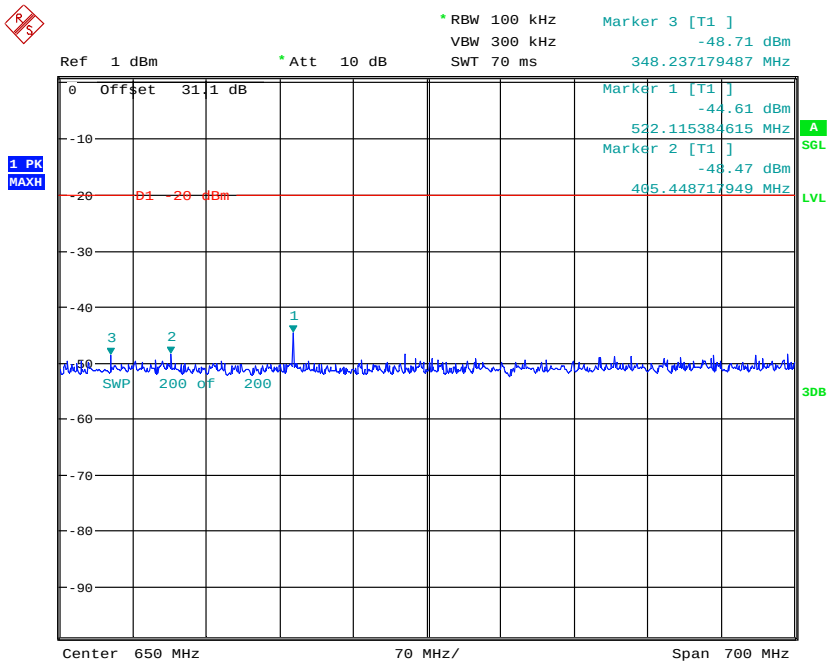
Product Service

300 MHz to 1 GHz



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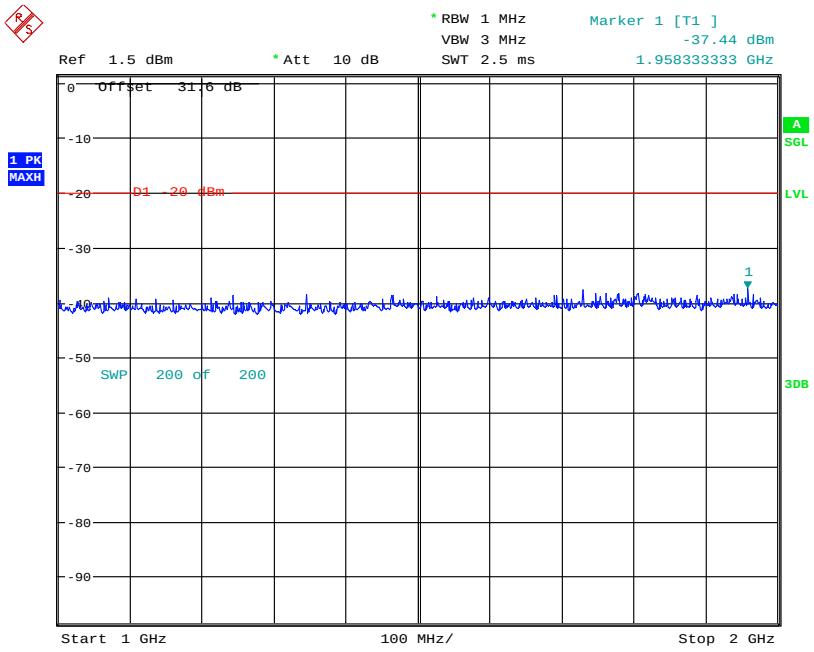
1 GHz to 2 GHz



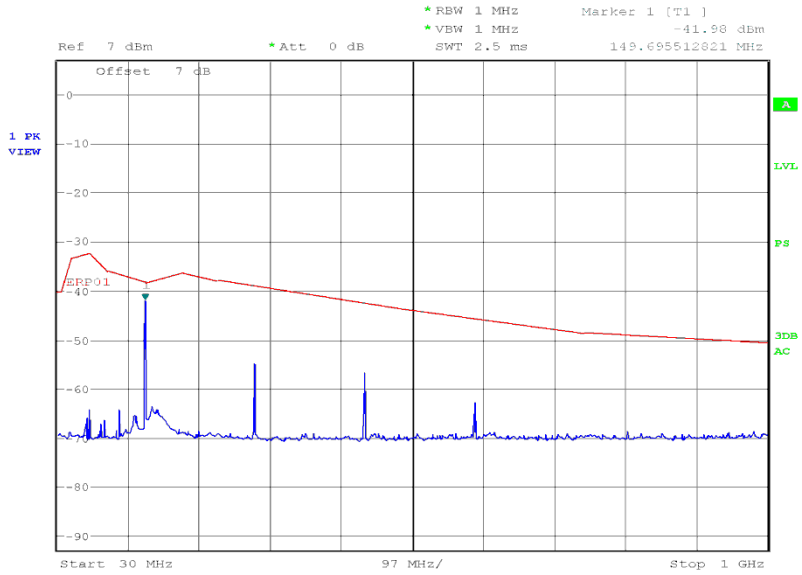
Date: 11.MAR.2014 13:34:41

Product Service

Radiated

150.0 MHz

30 MHz to 1 GHz



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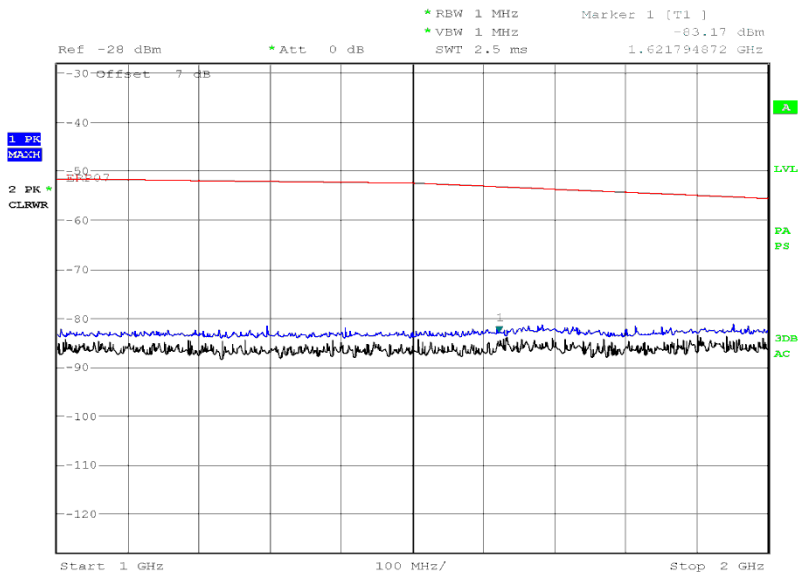
1 GHz to 2 GHz



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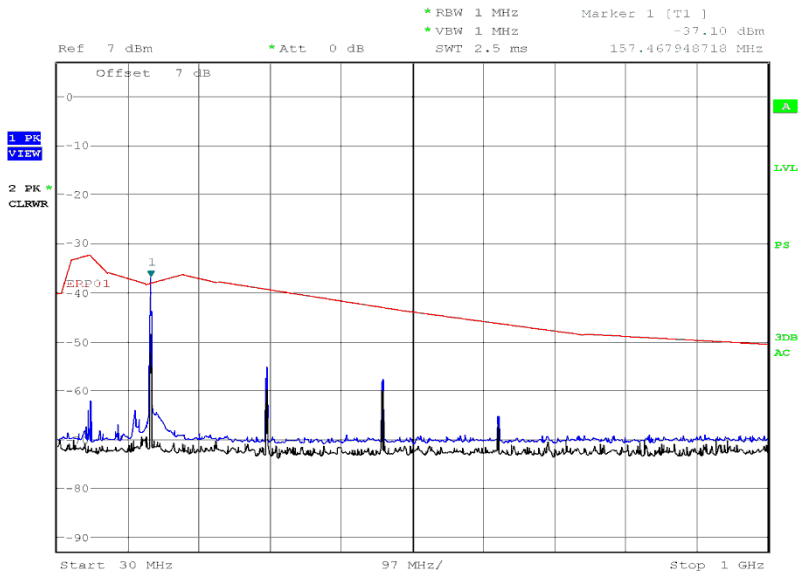
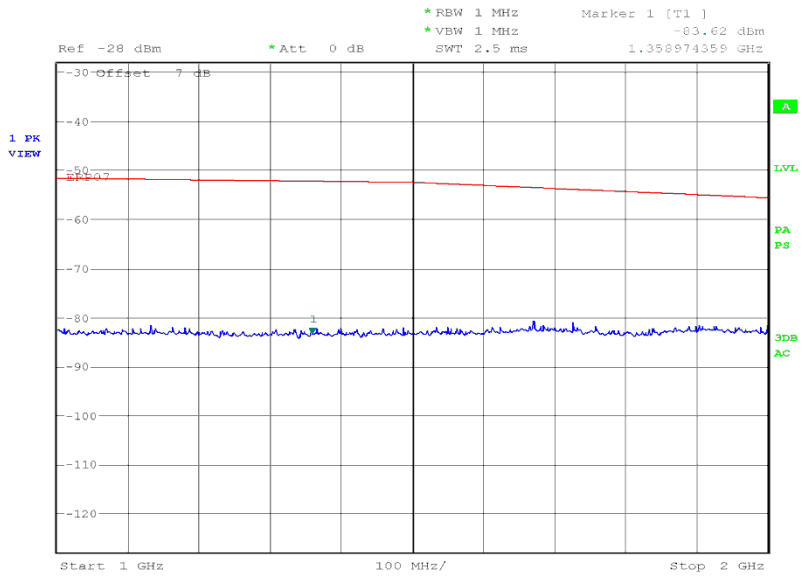
158.0 MHz

30 MHz to 1 GHz



Date: 21.MAR.2014 11:36:09

1 GHz to 2 GHz



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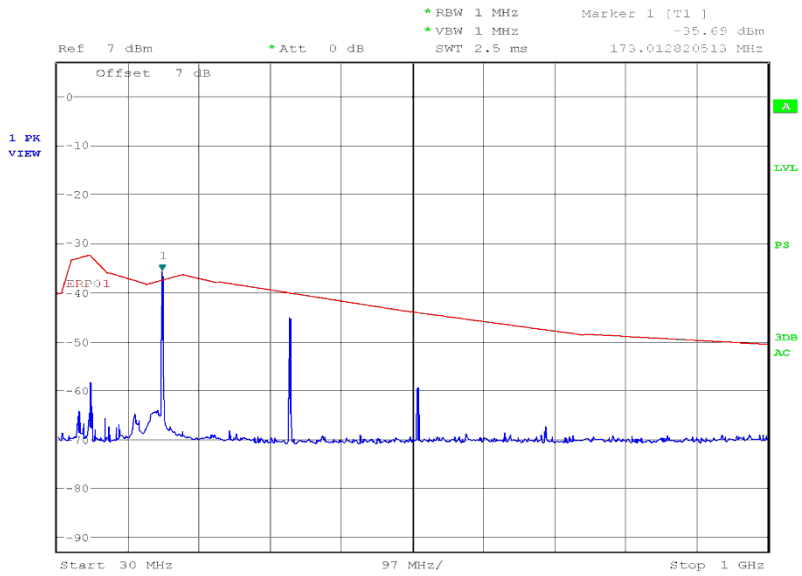
Product Service

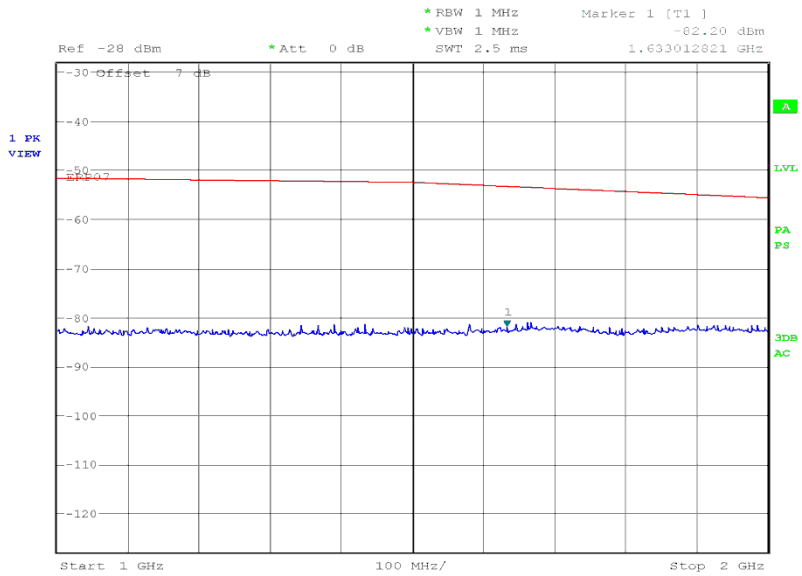
174.0 MHz

30 MHz to 1 GHz



Date: 21.MAR.2014 11:47:33

1 GHz to 2 GHz



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Product Service

Limit

(d) Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the centre of the authorized bandwidth f_0 to 5.625 kHz removed from f_0: Zero dB.

(2) On any frequency removed from the centre of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(f_d - 2.88 kHz) dB.

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

2.5 POWER AND ANTENNA HEIGHT LIMITS

2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1046
FCC CFR 47 Part 90, Clause 90.205

2.5.2 Equipment Under Test and Modification State

Inca Repeater S/N: S/N: 891050 - Modification State 0

2.5.3 Date of Test

26 February 2014

2.5.4 Test Equipment Used

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

2.5.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 90.205 (d) and KDB 971168.

The EUT was configured to transmit on maximum and minimum power on the bottom, middle and top channels with an unmodulated carrier. The EUT was connected to a spectrum analyser via a cable and attenuator. The path loss was measured using a network analyser and entered as a reference level offset in the spectrum analyser, the antenna gain was considered in this offset but the equipment uses an antenna with 0 dBi gain. The RBW of the spectrum analyser was set to 100 kHz and the video bandwidth to 300 kHz with the trace set to max hold using a peak detector and the result was recorded.

2.5.6 Environmental Conditions

Ambient Temperature	23.3°C
Relative Humidity	26.7%

2.5.7 Test Results

Maximum Output Power – 5W

12 V DC Supply

150.0 MHz

Result (dBm)	Result (W)
37.14	5.176

158.0 MHz

Result (dBm)	Result (W)
37.14	5.176

174.0 MHz

Result (dBm)	Result (W)
37.11	5.140

Minimum Output Power - 320 mW

12 V DC Supply

150.0 MHz

Result (dBm)	Result (W)
25.37	0.344

158.0 MHz

Result (dBm)	Result (W)
25.38	0.345

174.0 MHz

Result (dBm)	Result (W)
25.35	0.343

Product Service

Limit

	Service Area Radius (km)
	8
Maximum ERP (W)[1]	28
Up to reference HAAT (m) [3]	15

[1] Maximum ERP indicated provides for a 39 dBu signal strength at the edge of the service area per FCC Report R-6602, Fig.29 (see §73.699, Fig 10b).
[2] Maximum ERP of 500 watts allowed. Signal strength at the service area contour may be less than 37 dBu.
[3] When the actual antenna HAAT is greater than the reference HAAT, the allowable ERP will be reduced in accordance with the following equation: $ERP_{allow} = ERP_{max} \times (HAAT_{ref} HAAT_{actual})^2$.
[4] Applications for this service area radius may be granted upon specific request with justification and must include a technical demonstration that the signal strength at the edge of the service area does not exceed 37 dBu.

(s) The output power shall not exceed by more than 20 percent either the output power shown in the Radio Equipment List [available in accordance with § 90.203(a)(1)] for transmitters included in this list or when not so listed, the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

2.6 FREQUENCY STABILITY

2.6.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055
FCC CFR 47 Part 90, Clause 90.213

2.6.2 Equipment Under Test and Modification State

Inca Repeater S/N: 891050- Modification State 0

2.6.3 Date of Test

28 February 2014

2.6.4 Test Equipment Used

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

2.6.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 90.213 and FCC CFR 47 Part 2.1055 (a) (1), (d) (1).

The EUT was set to transmit on maximum power with an unmodulated carrier on bottom, middle and top channels. The EUT was connected to a frequency counter using an external 10 MHz frequency reference. The difference between the frequency of the fundamental and the frequency of the assigned channel in accordance with the manufactures documentation was recorded. In accordance with 2.1055, the temperature was varied from -30°C to +50° in 10° steps at both voltage minimum and maximum voltage extremes.

2.6.6 Environmental Conditions

Ambient Temperature	23.1°C
Relative Humidity	29.0%

Product Service

2.6.7 Test Results

12 V DC Supply

Temperature Interval	Supply Voltage	Frequency Error (ppm)		
		150.0 MHz	158.0 MHz	174.0 MHz
-30°C	10.20 V DC	-0.40	-0.40	-0.40
	13.80 V DC	-0.40	-0.40	-0.39
-20°C	10.20 V DC	-0.22	-0.04	-0.19
	13.80 V DC	-0.22	-0.05	-0.18
-10°C	10.20 V DC	-0.35	-0.35	-0.35
	13.80 V DC	-0.35	-0.35	-0.35
0°C	10.20 V DC	0.01	0.02	0.02
	13.80 V DC	0.01	0.02	0.02
+10°C	10.20 V DC	0.05	0.03	0.04
	13.80 V DC	0.05	0.03	0.03
+20°C	10.20 V DC	0.03	0.02	0.02
	13.80 V DC	0.03	0.03	0.02
-30°C	10.20 V DC	-0.20	-0.21	-0.23
	13.80 V DC	-0.20	-0.21	-0.23
+40°C	10.20 V DC	-0.20	-0.25	-0.26
	13.80 V DC	-0.20	-0.25	-0.26
+50°C	10.20 V DC	-0.21	-0.28	-0.26
	13.80 V DC	-0.21	-0.28	-0.26
Maximum Frequency Error (ppm)		-0.40	-0.40	-0.40

Limit

The frequency error shall not exceed 2.5 ppm

2.7 TRANSIENT FREQUENCY BEHAVIOUR

2.7.1 Specification Reference

FCC CFR 47 Part 90, Clause 90.214

2.7.2 Equipment Under Test and Modification State

Inca Repeater S/N: 891050 - Modification State 1

2.7.3 Date of Test

11/03/2014

2.7.4 Test Equipment Used

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

2.7.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 90.214.

The EUT was set to transmit on maximum power with an unmodulated carrier on bottom, middle and top channels. The EUT was connected to a spectrum analyser via a cable, attenuator and combiner. The other port of the combiner was connected to a signal generator which was configured to transmit an FM modulated 1kHz audio tone with ±12.5 kHz of deviation, at the same frequency of the fundamental of the EUT at a level 30 dB less than the fundamental of the EUT at the input of the spectrum analyser.

The spectrum analyser was configured to trigger when the IF bandwidth reached a level just greater than the level from the signal generator and the resultant traces for switch on and switch off was recorded.

2.7.6 Environmental Conditions

Ambient Temperature	24.0°C
Relative Humidity	28.1%

Product Service

2.7.7 Test Results

12 V DC Supply

Transient Period	Frequency Difference (kHz)		
	150.0 MHz	158.0 MHz	174.0 MHz
T_1	1.149	2.270	0.589
T_2	0.090	0.129	0.224
T_3	0.065	0.072	0.069

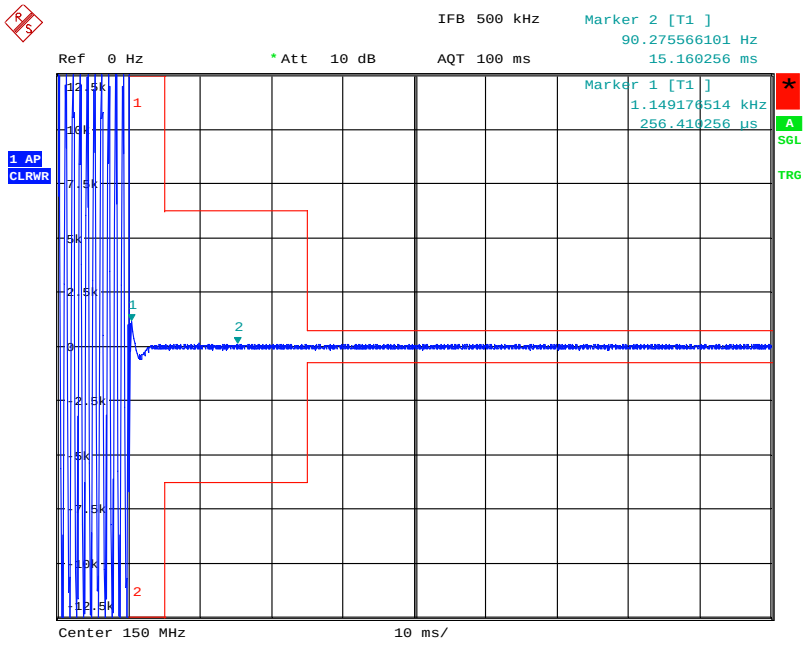
Limit

Time Interval	Maximum Frequency Difference	150 to 174 MHz, 12.5 kHz Channels
T_1	± 12.5 kHz	5.0 ms
T_2	± 6.25 kHz	20.0 ms
T_3	± 12.5 kHz	5.0 ms

Product Service

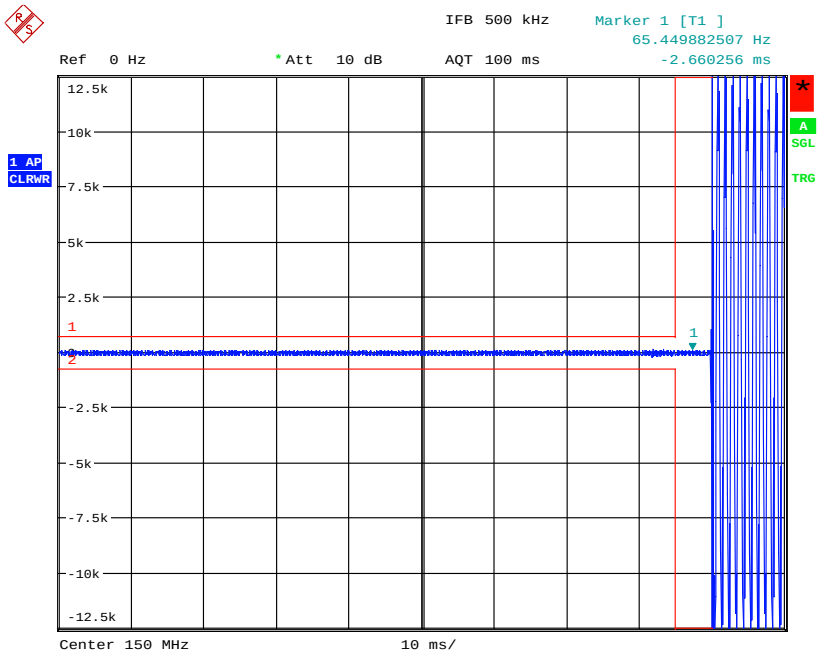
150.0 MHz

T_1 and T_2



Date: 11.MAR.2014 09:42:24

T_3

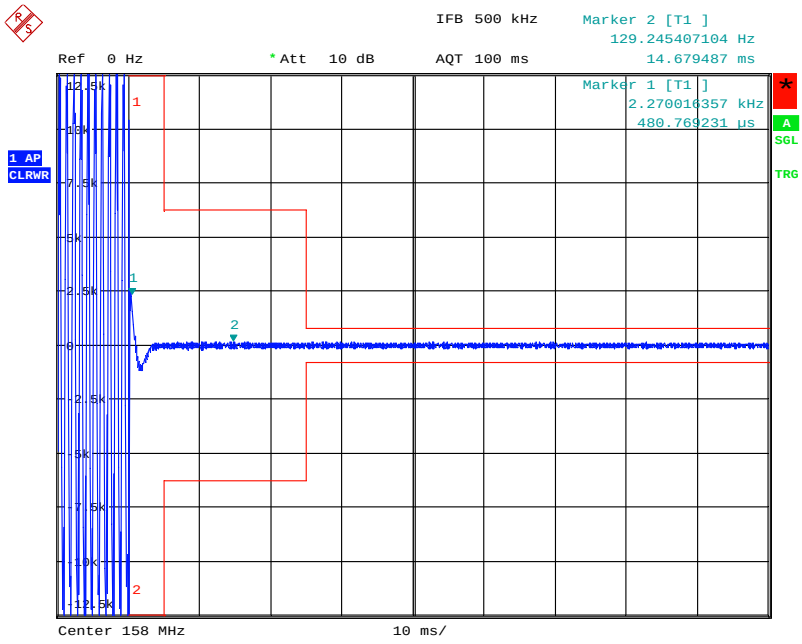


Date: 11.MAR.2014 09:41:18

Product Service

158.0 MHz

T_1 and T_2



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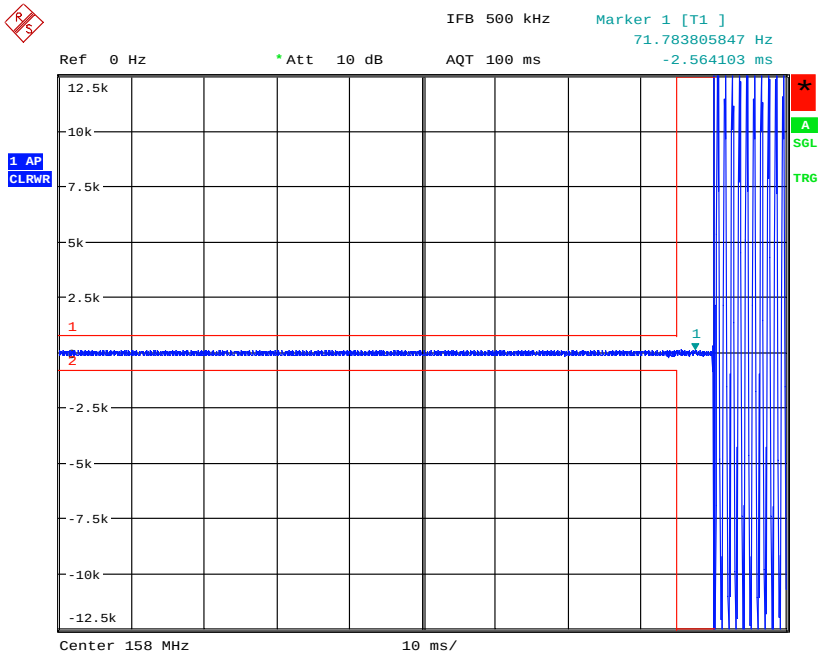
T_3



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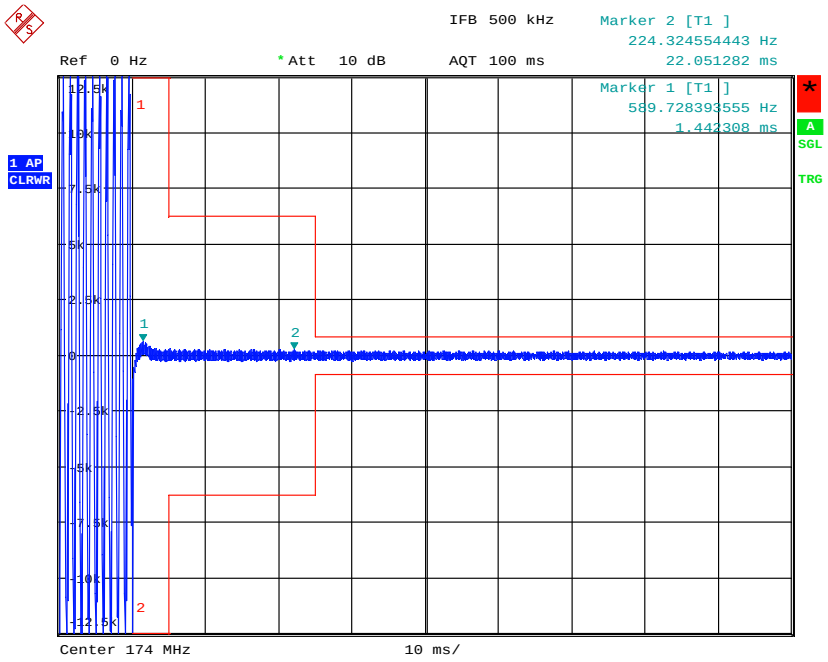
Product Service

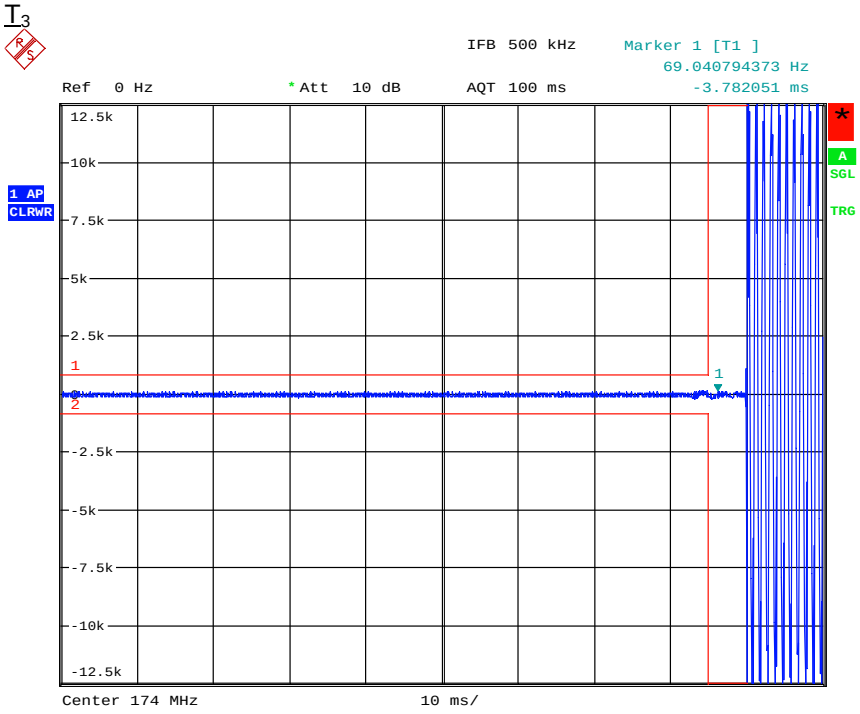
174.0 MHz

T_1 and T_2



Date: 11.MAR.2014 09:23:58

T_3



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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 - Effective Radiated Power					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	3-Apr-2014
Load (50ohm/30W)	Weinschel	50T-054	285	12	12-Sep-2014
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	1002	12	18-Sep-2014
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Audio Analyser	Hewlett Packard	8903B	1881	12	31-Oct-2014
Programmable Power Supply	Iso-tech	IPS 2010	2435	-	O/P Mon
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3096	12	5-Mar-2015
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	27-Mar-2014
Antenna (Log Periodic)	Schaffner	UPA6108	3108	12	15-May-2014
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Section 2.2 - Type of Emissions					
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Modulation Analyser	Hewlett Packard	8901B	773	12	3-Jun-2014
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	22-Jul-2014
Audio Analyser	Hewlett Packard	8903B	1881	12	31-Oct-2014
Sensor	Hewlett Packard	11722A	2787	12	28-Aug-2014
Hygrometer	Rotronic	I-1000	2891	12	8-Jul-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
1 Metre N Type Cable	Rhophase	NPS-1601A-1000-NPS	4102	12	11-Jun-2014
2 Metre N Type Cable	Rhophase	NPS-1601A-2000-NPS	4109	12	11-Jun-2014
Section 2.3 - Bandwidth Limitations					
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	22-Jul-2014
Audio Analyser	Hewlett Packard	8903B	1881	12	31-Oct-2014
Hygrometer	Rotronic	I-1000	2891	12	8-Jul-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
1 Metre N Type Cable	Rhophase	NPS-1601A-1000-NPS	4102	12	11-Jun-2014
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	22-Jul-2014

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.4 - Emission Mask					
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	3-Apr-2014
Load (50ohm/30W)	Weinschel	50T-054	285	12	12-Sep-2014
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	22-Jul-2014
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Audio Analyser	Hewlett Packard	8903B	1881	12	31-Oct-2014
Programmable Power Supply	Iso-tech	IPS 2010	2435	-	O/P Mon
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
Hygrometer	Rotronic	I-1000	2891	12	8-Jul-2014
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3096	12	5-Mar-2015
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3098	12	27-Mar-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	13-Sep-2014
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
1 Metre N Type Cable	Rhophase	NPS-1601A-1000-NPS	4102	12	11-Jun-2014
2 Metre N Type Cable	Rhophase	NPS-1601A-2000-NPS	4109	12	11-Jun-2014
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	18-Sep-2014
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	22-Jul-2014
Section 2.5 - Power and Antenna Height Limits					
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	22-Jul-2014
Hygrometer	Rotronic	I-1000	2891	12	8-Jul-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
1 Metre N Type Cable	Rhophase	NPS-1601A-1000-NPS	4102	12	11-Jun-2014
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	22-Jul-2014
Section 2.6 - Frequency Stability					
Counter	Hewlett Packard	53181A	159	12	28-May-2014
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Digital Temperature Indicator + T/C	Fluke	51	412	12	12-Feb-2015
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	22-Jul-2014
Hygrometer	Rotronic	I-1000	2891	12	8-Jul-2014
Attenuator (30dB, 150W)	Narda	769-30	3369	12	29-May-2014
2 Metre N Type Cable	Rhophase	NPS-1601A-2000-NPS	4109	12	11-Jun-2014
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	22-Jul-2014

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.9 - Transient Frequency Behaviour					
Signal Generator	Rohde & Schwarz	SMY 01	118	12	2-Oct-2014
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	12-Sep-2014
Attenuator (20dB, 150W)	Narda	769-20	3367	12	29-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Combiner/Splitter	Weinschel	1506A	3878	12	19-Mar-2014

TU – Traceability Unscheduled
O/P MON – Output Monitored with Calibrated Equipment

3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	MU
Emission Mask	Radiated: ± 3.08 dB Conducted: ± 3.454 dB
Effective Radiated Power	30MHz to 1GHz: ± 5.1 dB 1GHz to 40GHz: ± 6.3 dB
Power and Antenna Height Limits	± 0.7 dB
Transient Frequency Behaviour	± 0.2 Hz
Frequency Stability	± 42.47 Hz
Type of Emissions	-
Bandwidth Limitations	± 16.74 kHz

Product Service

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).