

TEST REPORT

KCTL Inc.

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Report No.: KCTL15-FR0006

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KCTL
<http://www.kctl.co.kr>

1. Applicant

Name: Continental Automotive Systems Corporation
Address: 45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea

2. Sample Description:

FCC ID: SY5HIIBU
IC ID: 8325A-HIIBU
Type of equipment: Smart Key ECU
Basic Model: HI IBU

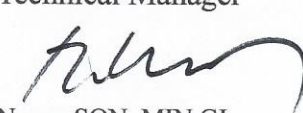
3. Date of Test: June 29 ~ July 01, 2015

4. Test method used: FCC Part 15 Subpart C
Section 15.209
IC RSS-210, Issue 8: December 2010
IC RSS-GEN, Issue 4: November 2014

5. Test Results

Test Item: Refer to page 6
Result: Refer to page 7 ~ page 18
Measurement Uncertainty: Refer to page 6

This result shown in this report refer only to the sample(s) tested unless otherwise stated.

Affirmation	Tested by 	Technical Manager
	Name: KIM, TAE YONG	 Name: SON, MIN GI

2015. 07. 22

KCTL Inc. Testing Laboratory

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1. Client information

Applicant: Continental Automotive Systems Corporation
Address: 45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
Telephone number: +82-31-645-4864
Facsimile number: +82-31-637-0371
Contact person: Sung Min, Jang / Sungmin.Jang@continental-corporation.com

Manufacturer: Continental Automotive Systems Corporation
Address: 45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea

2. Laboratory information

Address

KCTL INC.

65, Sinwon-ro, Yeongtong-gu, Gyeonggi-do, Suwon-si, 443-390, Korea

Telephone Number: 82-70-5008-1016 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: 231

FCC Site Designation No.: KR0040

FCC Site Registration No.: 687132

VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849

IC Site Registration No.:8035A-2

SITE MAP



3. Description of E.U.T.

3.1 Basic description

Applicant:	Continental Automotive Systems Corporation
Address of Applicant	45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
Manufacturer	Continental Automotive Systems Corporation
Address of Manufacturer	45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
Type of equipment	Smart Key ECU
Basic Model	HI IBU
Serial number	N/A

3.2 General description

Frequency	125 kHz (Tx), 433.92 MHz (Rx)
Type of Modulation	ASK
Number of Channels	1 channel
Type of Antenna	LF Antenna
Power supply	DC 12 V
Product SW/HW version	1.0
Radio SW/HW version	1.0
Test SW Version	N/A ¹⁾
RF power setting in TEST SW	N/A ²⁾

*Note. N/A¹⁾ No test SW was used during testing.

N/A²⁾ RF power setting was not able to alter during testing.

3.3 Test frequency

	Frequency
Low frequency	-
Middle frequency	125 kHz
High frequency	-

4. Summary of test results

4.1 Standards & results

FCC Rule Reference	IC Rule	Parameter	Report Section	Test Result
15.203	-	Antenna Requirement	5.1	C
15.209	-	Field Strength of Fundamental	5.2	C
15.209	RSS GEN 6.13	Radiated Emissions	5.3	C
N/A	RSS GEN 6.6	Occupied bandwidth	5.4	C
N/A	RSS GEN 7.1	Receiver Spurious Emission	5.5	C
15.207(a)	RSS-GEN, 8.8	Conducted Emissions	5.6	N/A ₁₎

Note: C=complies
NC= Not complies
NT=Not tested
NA=Not Applicable

*N/A₁₎ This test is not applicable because the EUT falls into the automotive device and it's not to be connected to the public utility(AC) power line.

4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = KU_c$ ($K = 2$)	
Conducted RF power	± 1.30 dB	
Conducted Spurious Emissions	± 1.52 dB	
Radiated Spurious Emissions	30 MHz ~ 300 MHz:	+ 4.94 dB, - 5.06 dB
		+ 4.93 dB, - 5.05 dB
	300 MHz ~ 1 000 MHz:	+ 4.97 dB, - 5.08 dB
		+ 4.84 dB, - 4.96 dB
	1 GHz ~ 25 GHz:	+ 6.03 dB, - 6.05 dB
Conducted Emissions	9 kHz ~ 150 kHz:	± 3.75 dB
	150 kHz ~ 30 MHz:	± 3.36 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

5.1.2 Result

-Complied

Using permanent attached antenna and has no general access to end user after it has been installed.

5.2 Field Strength of Fundamental Emissions

5.2.1 Regulation

According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field strength (μV/m @ 3m)	Distance(m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**Except as provided in paragraph(g), fundamental emissions from intentional radiators operating under the section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, Operation within these frequency bands is permitted under other sections of this part. e.g., Section 15.231 and 15.241.

**Limit : $2400/125=19.2 \text{ uV/m @ 300m}$
Distance Correction Factor = $40\log(\text{test distance / specific distance})$

5.2.2 Measurement Procedure

Test Procedure The Radiated Electric Field Strength intensity has been measured on semi anechoic chamber with a ground plane and at a distance of 3m.

Frequency : From 9 kHz to 30 MHz at distance 3m The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

Frequency : From 30 MHz to 1 GHz at distance 3m The measuring antenna height varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization.

On any frequency or frequencies below or equal to 1 000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission. As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, as long as the same bandwidths as indicated for CISPR quasi-peak measurements are employed.(15.35(a))

below 1GHz : quasi-peak

* Part 15 Section 15.31 (f)(2) (9 kHz-30 MHz)

[Limit at 3 m]=[Limit at 300 m]-40 x log(3[m]/300[m])

[Limit at 3 m]=[Limit at 30 m]-40 x log (3[m]/30[m])

5.2.3 Test Result

-Complied

ANT 1 _INT 1

Measurement Distance: 3 m

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μ V/m)]	Pol. [V/H]	Factor [dB]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]
QP DATA.							
0.125	0.2	76.8	H	19.1	95.9	105.7	9.8

*worstcase Horizontal

ANT 2 _INT 2

Measurement Distance: 3 m

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μ V/m)]	Pol. [V/H]	Factor [dB]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]
QP DATA.							
0.125	0.2	77.7	H	19.1	96.8	105.7	8.9

*worstcase Horizontal

ANT 3 _Bumper

Measurement Distance: 3 m

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μ V/m)]	Pol. [V/H]	Factor [dB]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]
QP DATA.							
0.125	0.2	76.5	H	19.1	95.6	105.7	10.1

*worstcase Horizontal

ANT 4 _Immo

Measurement Distance: 3 m

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μ V/m)]	Pol. [V/H]	Factor [dB]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]
QP DATA.							
0.125	0.2	61.8	H	19.1	80.9	105.7	24.8

*worstcase Horizontal

ANT 5_Assistant

Measurement Distance: 3 m

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV/m)]	Pol. [V/H]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
QP DATA.							
0.125	0.2	59.6	H	19.1	78.7	105.7	27.0

*worstcase Horizontal

ANT 6_Trunk

Measurement Distance: 3 m

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV/m)]	Pol. [V/H]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
QP DATA.							
0.125	0.2	76.3	H	19.1	95.4	105.7	10.3

*worstcase Horizontal

ANT 7_Hat-shelf

Measurement Distance: 3 m

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV/m)]	Pol. [V/H]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
QP DATA.							
0.125	0.2	61.6	H	19.1	80.7	105.7	25.0

*worstcase Horizontal

Margin (dB) = Limit – Actual

[Result] = Reading – Amp Gain + Attenuator + AF + CL

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10 dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

5.3 Radiated Emissions

5.3.1 Regulation

According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field strength ($\mu\text{V/m}$ @ 3 m)	Distance(m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**Except as provided in paragraph(g).fundamental emissions from intentional radiators operating under the section shall not be located in the frequency bands 54-72 MHz. 76-88 MHz. 174-216 MHz or 470-806 MHz. However, Operation within these frequency bands is permitted under other sections of this part. e.g., Section 15.231 and 15.241.

**Limit : $2400/125=17.78\mu\text{V/m}$ @ 300 m
Distance Correction Factor $\propto = 40\log(\text{test distance} / \text{specific distance})$

5.3.2 Measurement Procedure

The spurious emissions from the EUT will be measured on an open area test site in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna.

The antenna was positioned 3, 10 or 30 meters horizontally from the EUT.

Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions.

In the case where larger measuring distances are required the results will extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2].

The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209 (d) [2].

The final level, expressed in $\text{dB}\mu\text{V/m}$, is arrived at by taking the reading from the EMI receiver (Level $\text{dB}\mu\text{V}$) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit. The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: ResBW: 200 Hz

150 kHz – 30 MHz: ResBW: 9 kHz

5.3.3 Test Result

-Complied

INT 2_ANT (Worst Case)

Measurement Distance: 3 m

-Below 30 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	Factor [dB]	Limit [dB(μV/m)]	Result [dB(μV/m)]	Margin [dB]
QP DATA.							
16.77	9	13.20	V	20.40	49.50	33.60	15.90

-Above 30 MHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB(μV)]	Pol. [V/H]	Factor [dB]	Limit [dB(μV/m)]	Result [dB(μV/m)]	Margin [dB]
QP DATA.							
35.70	120	38.50	V	-19.10	40.00	19.40	20.60
57.77	120	36.30	V	-17.30	40.00	19.00	21.00
159.98	120	32.30	H	-20.90	43.50	11.40	32.10
947.62	120	27.00	H	-1.80	46.00	25.20	20.80
990.91	120	26.90	H	-1.10	54.00	25.80	28.20

Margin (dB) = Limit – Actual

[Result] = Reading – Amp Gain + Attenuator + AF + CL

1. H = Horizontal, V = Vertical Polarization

2. ATT = Attenuation (10dB pad and/or Insertion Loss of HPF), AF/CL = Antenna Factor and Cable Loss

* The spurious emission at the frequency does not fall in the restricted bands.

** The measured result is within the test standard limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95 % level of confidence. However, the result indicates that compliance is more probable than non-compliance.

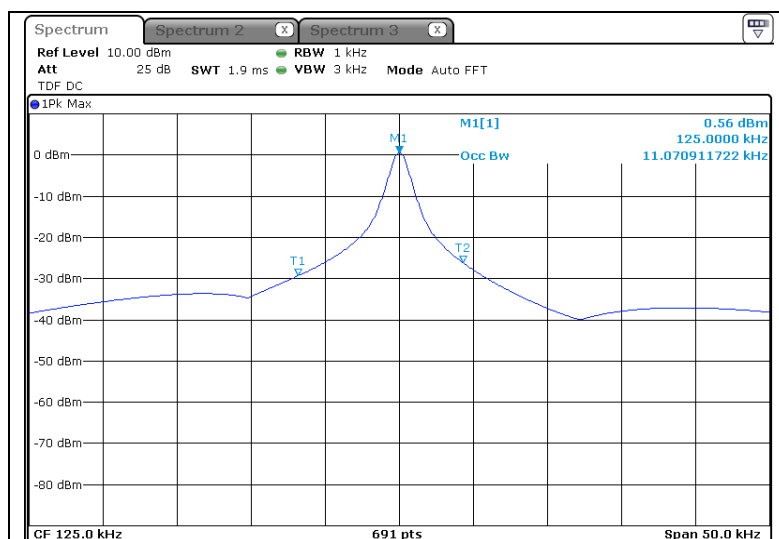
NOTE: All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

5.4 Occupied bandwidth

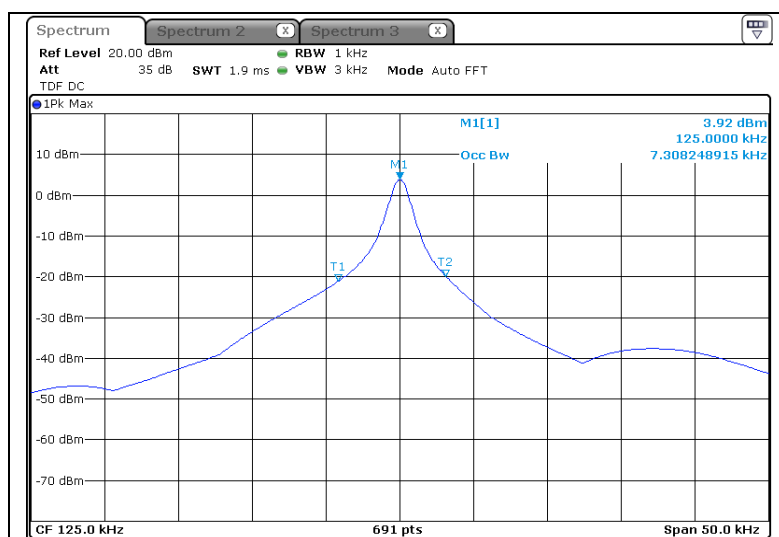
5.4.1 Test Result

-Complied

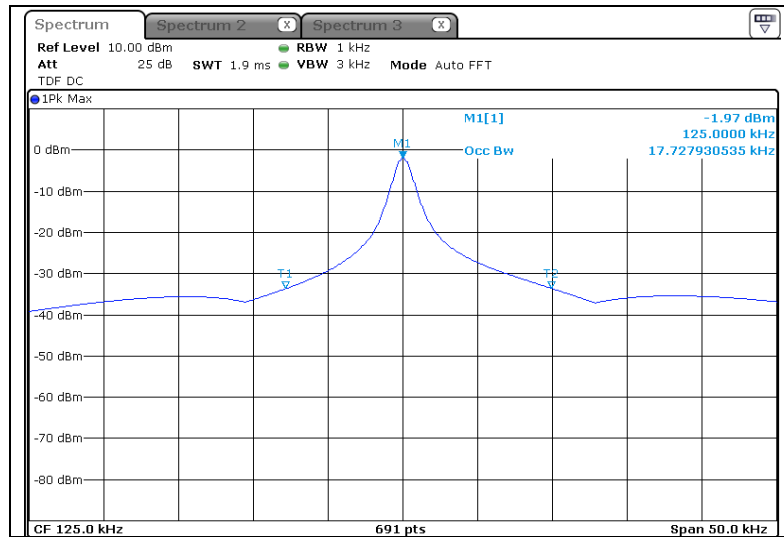
ANT 1_INT 1



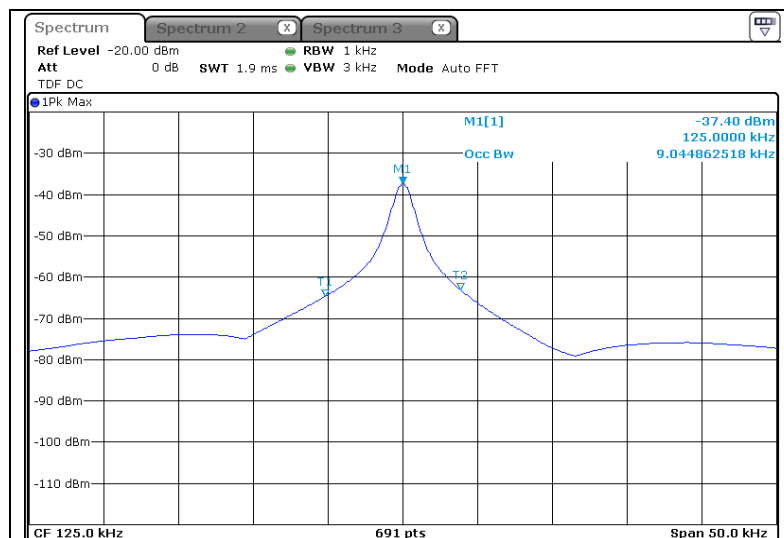
ANT 2_INT 2



ANT 3_Bumper



ANT 4_Immo



Spectrum 2 Spectrum 3

Ref Level 0.00 dBm Att 15 dB SWT 1.9 ms RBW 1 kHz VBW 3 kHz Mode Auto FFT

TDF DC

1Pk Max

M1

M1[1]

-13.58 dBm

125.0000 kHz

19.247467438 kHz

T1

T2

Occ Bw

CF 125.0 kHz 691 pts Span 50.0 kHz

Spectrum 2 X Spectrum 3 X

Ref Level 20.00 dBm RBW 1 kHz

Att 35 dB SWT 1.9 ms VBW 3 kHz Mode Auto FFT

TDF DC

1Pk Max

10 dBm

0 dBm

-10 dBm

-20 dBm

-30 dBm

-40 dBm

-50 dBm

-60 dBm

-70 dBm

M1[1]

2.94 dBm

125.0000 kHz

8.031837916 kHz

M1

T1

T2

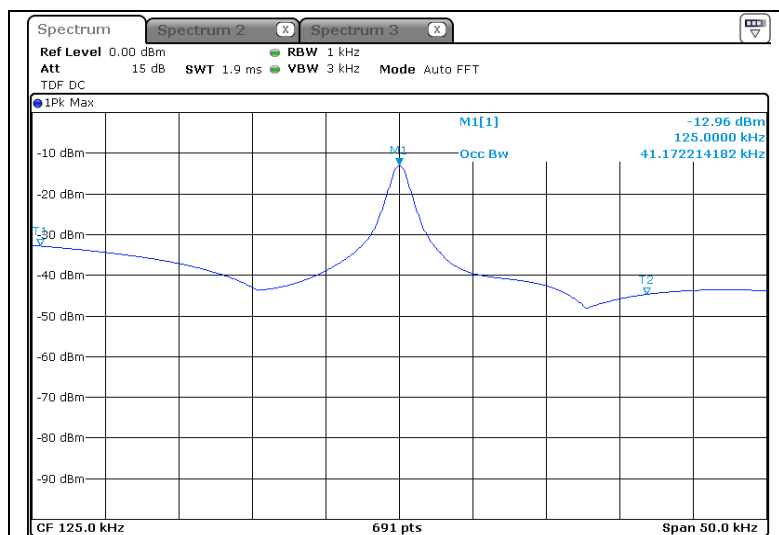
Occ BW

CF 125.0 kHz

601 pts

Span 50.0 kHz

ANT 7_Hat-shelf



5.5 Receiver Spurious Emission

5.5.1 Measurement Procedure

The receiver shall be operated in the normal receive mode near the mid-point of the band in which the receiver is designed to operate. Radiated emission measurements are to be performed on a test site registered with Industry Canada. As an alternative, the conducted measurement method may be used when the antenna is detachable. In such a case, the receiver spurious signal may be measured at the antenna port. If the receiver is super-regenerative, stabilize it by coupling to it an unmodulated carrier on the receiver frequency (antenna conducted measurement) or by transmitting an unmodulated carrier on the receiver frequency from an antenna in the proximity of the receiver (radiated measurement). Taking care not to overload the receiver, vary the amplitude and frequency of the stabilizing signal to obtain the highest level of the spurious emissions from the receiver. For either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is higher, to at least 3 times the highest tuneable or local oscillator frequency, whichever is higher, without exceeding 40 GHz. For emissions below 1 000 MHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization as required, with an equal or greater measurement bandwidth relative to the applicable CISPR quasi-peak bandwidth.

5.5.2 Receiver Spurious Emission Limits

Receivers shall comply with the limits of spurious emissions set out in this section, measured over the frequency range determined in accordance with Section 4.10.

5.5.3 Radiated Limits

Radiated spurious emission measurements shall be performed with the receiver antenna connected to the receiver antenna terminals.

Spurious emissions from receivers shall not exceed the radiated limits shown in the table below:

Table 2: Radiated Limits of Receiver Spurious Emissions

Frequency (MHz)	Field Strength (microvolts/m at 3 metres)*
30-88	100
88-216	150
216-960	200
Above 960	500

*Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 7.2.7.

5.5.4 Test Result

-Below 1 GHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB (μV)]	Pol. [V/H]	Factor [dB]	Limit [dB (μV/m)]	Result [dB (μV/m)]	Margin [dB]
QP DATA.							
Below 1 000.00	Not Detected	-	-	-	-	-	-

-Above 1 GHz

Frequency [MHz]	Receiver Bandwidth [kHz]	Reading [dB (μV)]	Pol. [V/H]	Factor [dB]	Limit [dB (μV/m)]	Result [dB (μV/m)]	Margin [dB]
QP DATA.							
Above 1 000.00	Not Detected	-	-	-	-	-	-

6. Test equipment used for test

	Description	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	Spectrum Analyzer	R&S	FSV40	100988	16.01.26
■	Signal generator	R&S	SMR40	100007	16.06.15
■	DC Power Supply	AGILENT	E3632A	MY40004399	16.01.06
■	EMI Test Receiver	R&S	ESCI	100001	15.07.14
■	Loop Antenna	R&S	HFH2-Z2	861971003	17.03.03
■	Bi-Log Antenna	SCHWARZBECK	VULB9163	552	16.05.14
■	Horn antenna	ETS.lindgren	3117	155787	16.02.05
■	Amplifier	HP	8447D	2944A09626	16.01.19
■	Broadband Preamplifier	SCHWARZBECK	BBV9718	216	16.05.19
■	Attenuator	HP	8491A	MY52460424	15.07.23
■	Turn Table	Innco Systems	DT2000S-1t	79	-
■	Antenna Mast	Innco Systems	MA4000-EP	303	-