TEST REPORT

KCTL Inc.
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Suwon-si, Gyeonggi-do, 443-390, Korea
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KCTL
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1. Applicant

Name:	Hyundai Mobis Co., Ltd.
Address:	203, Teheran-ro, Gangnam-gu, Seoul, 135-977, Korea

2. Sample Description:

FCC ID:	TQ8-ATC40G2AN
Type of equipment:	DIGITAL CAR AVN SYSTEM
Basic Model:	ATC40G2AN

3. Date of Test: September 21 ~ October 07, 2015

4. Test method used: FCC Part 27

5. Test Results

Test Item:	Refer to page 8
Result:	Refer to page 10 ~ page 17
Measurement Uncertainty:	Refer to page 9

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

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

2015. 10. 08

KCTL Inc. Testing Laboratory

[Contents]

1. Client information

Applicant:	Hyundai Mobis Co., Ltd.
Address:	203, Teheran-ro, Gangnam-gu, Seoul, 135-977, Korea
Telephone number:	+81-31-260-2707
Facsimile number:	+81-31-899-1788
Contact person:	Choi Seung Hoon / csh@mobis.co.kr

Manufacturer:	Hyundai Mobis Co., Ltd.
Address:	95, Sayang 2-Gil, Munbaek-Myeon, Jincheon-Gun, Chungcheongbuk-Do 365-862 Korea

2. Laboratory information

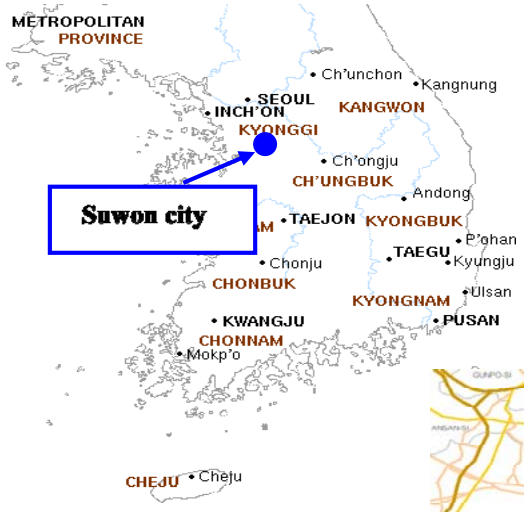
Address

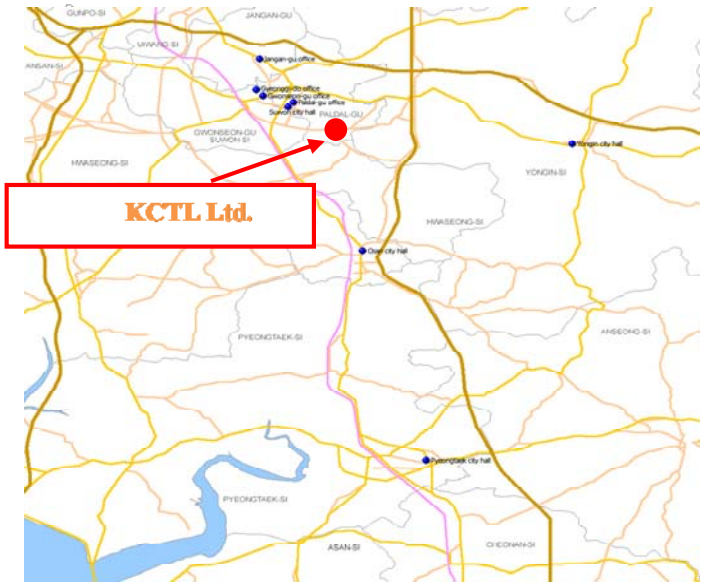
KCTL Ltd.
65 Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea
Telephone Number: 82-70-5008-1016 Facsimile Number: 82-505-299-8311

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	Hyundai Mobis Co., Ltd.
Address of Applicant	203, Teheran-ro, Gangnam-gu, Seoul, 135-977, Korea
Manufacturer	Hyundai Mobis Co., Ltd.
Address of Manufacturer	95, Sayang 2-Gil, Munbaek-Myeon, Jincheon-Gun, Chungcheongbuk-Do 365-862 Korea
Type of equipment	DIGITAL CAR AVN SYSTEM
Basic Model	ATC40G2AN
Serial number	N/A

3.2 General description

Frequency Range	2 402 ㎒ ~ 2 480 ㎒ (Bluetooth) 2 412 ㎒ ~ 2 462 ㎒ (802.11b/g/n_HT20) 824.70 ㎒ ~ 848.31 ㎒ (CDMA 800) 1 851.25 ㎒ ~ 1 908.75 ㎒ (CDMA1 900) 779.5 ㎒ ~ 784.5 ㎒ (LTE Band 13) 1 710.7 ㎒ ~ 1 754.3 ㎒ (LTE Band 4)
Type of Modulation	GFSK, π/4DQPSK, 8DPSK (Bluetooth), DSSS (802.11b), OFDM (802.11g/n_HT20) 1xRTT (CDMA800, CDMA1 900) QPSK, 16QAM (LTE Band 13, LTE Band 4)
Type of Antenna	79 ch (Bluetooth), 11 ch (802.11b/g/n_HT20)
Antenna Gain	External Antenna
Transmit Power	-0.4 dBi (Bluetooth) , 3.08 dBi (802.11b/g/n_HT20), 3.35 dBi (CDMA 800) 7.0 dBi (CDMA 1 900) 3.16 dBi (LTE Band 13) 4.29 dBi (LTE Band 4)
Transmit Power	23.9 dBm
Power supply	DC 14.4 V
Product SW/HW version	1.0
Radio SW/HW version	1.0
Test SW Version	Refer to the # DRTFCC1408-1021(1) (Model Name: LTD-VL1000, FCC ID: YZP-VL1000)
RF power setting in TEST SW	Refer to the # DRTFCC1408-1021(1) (Model Name: LTD-VL1000, FCC ID: YZP-VL1000)

Note : The above EUT information was declared by the manufacturer.

3.3 Test frequency Test mode

The transmitter has a maximum average output power as follows:

Mode	Tx Frequency (㎒)	Rx Frequency (㎒)	Modulation	Conducted Power	
				Max power (dBm)	Max power (W)
LTE Band 13	779.5 ~ 784.5	748.5 ~ 753.5	QPSK	23.28	0.213
LTE Band 13	779.5 ~ 784.5	748.5 ~ 753.5	16QAM	22.23	0.167
LTE Band 13	782	751	QPSK	23.26	0.212
LTE Band 13	782	751	16QAM	22.22	0.167
LTE Band 4	1 710.7 ~ 1 754.3	2 110.7 ~ 2 154.3	QPSK	23.50	0.224
LTE Band 4	1 710.7 ~ 1 754.3	2 110.7 ~ 2 154.3	16QAM	22.57	0.181
LTE Band 4	1 711.5 ~ 1 753.5	2 111.5 ~ 2 153.5	QPSK	23.62	0.230
LTE Band 4	1 711.5 ~ 1 753.5	2 111.5 ~ 2 153.5	16QAM	22.62	0.183
LTE Band 4	1 712.5 ~ 1 752.5	2 112.5 ~ 2 152.5	QPSK	23.90	0.245
LTE Band 4	1 712.5 ~ 1 752.5	2 112.5 ~ 2 152.5	16QAM	22.91	0.195
LTE Band 4	1 715 ~ 1 750	2 115 ~ 2 150	QPSK	23.68	0.233
LTE Band 4	1 715 ~ 1 750	2 115 ~ 2 150	16QAM	22.88	0.194
LTE Band 4	1 717.5 ~ 1 747.5	2 117.5 ~ 2 147.5	QPSK	23.67	0.233
LTE Band 4	1 717.5 ~ 1 747.5	2 117.5 ~ 2 147.5	16QAM	22.92	0.196
LTE Band 4	1 720 ~ 1 745	2 120 ~ 2 145	QPSK	23.60	0.229
LTE Band 4	1 720 ~ 1 745	2 120 ~ 2 145	16QAM	22.83	0.195

3.4 Test Voltage

mode	Voltage
Norminal voltage	DC 14.4 V

4. Summary of test results

4.1 Standards & results

FCC Part 27			
FCC Rule Reference	Parameter	Report Section	Test Result
§2.1046	Conducted Output Power	5.1	N/A1)
§2.1049	Occupied Bandwidth	5.2	N/A1)
§24.232(d)	Peak to Average Ratio	5.3	N/A1)
§2.1051 §27.53(c.2) §27.53(h)	Undesirable Emissions at band edge and for all out-of-band emissions (Conducted)	5.4	N/A1)
§2.1055 §27.54	Frequency Stability	5.5	N/A1)
§27.50(b.10)	Effective Radiated Power	5.6	C
§27.50(d.4)	Equivalent Isotropic Radiated Power		C
§2.1051 §27.53(c.2) §27.53(h)	Undesirable Emissions (Radiated)	5.7	C
§27.53(f)	Undesirable Emissions in 1 559 ~ 1 610 ㎒		C
§27.53(c.4)	Undesirable Emissions in 763 ~ 775 ㎒ & 793 ~ 805 ㎒		C
§15.207(a)	Conducted Emissions	-	N/A2)

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

N/A1) : Refer to the RF test report # DRTFCC1408-1021(1), FCC ID #YZP-VL1000

N/A2) : The test is not applicable since the EUT is not the device that is designed to be connected to the public utility(AC) power line(This EUT is automotive device)

4.2 Uncertainty

Measurement Item	Expanded Uncertainty U = KUc (K = 2)	
Conducted RF power	± 1.36 dB	
Occupied Bandwidth	± 2.54 kHz	
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 ~ 6 GHz:	+ 6.03 dB, - 6.05 dB
	6 GHz ~ 25 GHz:	+ 6.41 dB, - 6.53 dB

5. Test results

5.1 Effective Radiated Power

5.1.1 Measurement Procedure

ANSI/TIA/EIA 603C Clause 2.2.17
KDB 971168 v02r02 Radiated measurement consideration for RF output power.
KDB 971168 D1 Power Meas License Digial Systems v02r02, “Measurement Guidance for Certification of Licensed Digial Transmetters”

5.1.2 Limit

27.50 (b)(10) Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

27.50 (d)(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

5.6.3 Test Result

Band 13

5 ㎒ Bandwidth

Mode	RB/RB SIZE	Frequency (㎒)	ERP (Average)	EIRP (Average)	
			dB(μV/m)	dBm	W
5 MHz Band QPSK	6/0	779.5	108.30	15.25	0.03
		784.5	108.40	15.35	0.03
		779.5	108.30	15.25	0.03
5 MHz Band 16QAM	6/0	784.5	108.50	15.45	0.04
		779.5	108.30	15.25	0.03
		784.5	108.40	15.35	0.03

10 ㎒ Bandwidth

Mode	RB/RB SIZE	Frequency (㎒)	ERP (Average)	EIRP (Average)	
			dB(μV/m)	dBm	W
10 MHz Band QPSK	15/0	782.0	107.50	14.45	0.03
10 MHz Band 16QAM	15/0	782.0	107.70	14.65	0.03

Band 4

1.4 ㎒ Bandwidth

Mode	RB/RB SIZE	Frequency (㎒)	ERP (Average)	EIRP (Average)	
			dB(μV/m)	dBm	W
1.4 MHz Band QPSK	6/0	1 710.7	118.70	25.65	0.37
		1 732.5	121.30	28.25	0.67
		1 754.3	121.30	28.25	0.67
1.4 MHz Band 16QAM	6/0	1 710.7	118.40	25.35	0.34
		1 732.5	121.60	28.55	0.72
		1 754.3	121.20	28.15	0.65

3 ㎒ Bandwidth

Mode	RB/RB SIZE	Frequency (㎒)	ERP (Average)	EIRP (Average)	
			dB(μV/m)	dBm	W
3 MHz Band QPSK	15/0	1 711.5	116.70	23.65	0.23
		1 732.5	119.40	26.35	0.43
		1 753.5	119.40	26.35	0.43
3 MHz Band 16QAM	15/0	1 711.5	116.80	23.75	0.24
		1 732.5	119.60	26.55	0.45
		1 753.5	119.20	26.15	0.41

5 ㎒ Bandwidth

Mode	RB/RB SIZE	Frequency (㎒)	ERP (Average)	EIRP (Average)	
			dB(μV/m)	dBm	W
5 MHz Band QPSK	25/0	1 712.5	115.60	22.55	0.18
		1 732.5	118.20	25.15	0.33
		1 752.5	118.30	25.25	0.33
5 MHz Band 16QAM	25/0	1 712.5	116.10	23.05	0.20
		1 732.5	118.80	25.75	0.38
		1 752.5	118.60	25.55	0.36

10 ㎒ Bandwidth

Mode	RB/RB SIZE	Frequency (㎒)	ERP (Average)	EIRP (Average)	
			dB(μV/m)	dBm	W
10 MHz Band QPSK	50/0	1 715.0	114.90	21.85	0.15
		1 732.5	117.40	24.35	0.27
		1 750.0	116.70	23.65	0.23
10 MHz Band 16QAM	50/0	1 715.0	115.30	22.25	0.17
		1 732.5	116.40	23.35	0.22
		1 750.0	116.10	23.05	0.20

15 ㎒ Bandwidth

Mode	RB/RB SIZE	Frequency (㎒)	ERP (Average)	EIRP (Average)	
			dB(μV/m)	dBm	W
15 MHz Band QPSK	75/0	1 717.5	114.30	21.25	0.13
		1 732.5	115.60	22.55	0.18
		1 747.5	115.70	22.65	0.18
15 MHz Band 16QAM	75/0	1 717.5	113.40	20.35	0.11
		1 732.5	116.20	23.15	0.21
		1 747.5	114.70	21.65	0.15

20 ㎒ Bandwidth

Mode	RB/RB SIZE	Frequency (㎒)	ERP (Average)	EIRP (Average)	
			dB(μV/m)	dBm	W
20 MHz Band QPSK	100/0	1 720.0	114.80	21.75	0.15
		1 745.0	115.50	22.45	0.18
20 MHz Band 16QAM	100/0	1 720.0	114.10	21.05	0.13
		1 745.0	115.40	22.35	0.17

5.2 Undesirable emissions (Radiated)

5.2.1 Measurement Procedure

1. On a test site, the EUT shall be placed at 80 cm height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. During the measurement of the EUT, the resolution bandwidth was to 3 MHz and the video bandwidth was set to 3 MHz.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
7. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. The EUT was replaced by half-wave dipole or horn antenna connected to a signal generator.
11. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
12. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
13. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
14. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

5.2.2 Limit

27.53 (c)(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB.

27.53 (h) For operations in the 1710-1755 MHz and 2110-2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.

5.2.2 Test Result

Undesirable emissions (Band 13)

Bandwidth [㎒]	Test Freq, [㎒]	RB/ Offset Size	Test Mode	Freq, [㎒]	Ant Pol [H/V]	Level [dBuV/m]	Result e.i.r.p. [dBm]	Margin [dB]	Limit [dBm]
5.0	779.5	0/1	QPSK	748.44	H	33.0	-62.2	49.2	-13.0
				1678.38	H	44.00	-51.2	38.2	-13.0
				2393.88	V	48.40	-46.8	33.8	-13.0
				3167.88	V	48.00	-47.2	34.2	-13.0
	784.5	0/1	QPSK	752.71	V	44.10	-51.1	38.1	-13.0
				776.48	V	34.90	-60.3	47.3	-13.0
				1994.50	V	46.10	-49.1	36.1	-13.0
				2393.88	H	47.60	-47.6	34.6	-13.0
10.0	782	0/1	QPSK	3192.63	H	48.20	-47.0	35.0	-12.0
				748.86	H	45.30	-49.9	36.9	-13.0
				1994.50	V	45.60	-49.6	36.6	-13.0
				2395.00	V	47.90	-47.3	34.3	-13.0

Note 1: This device was tested under all modulations, RB size and RB offsets and the worst case data are reported in the table above. (The worst case mode is the QPSK modulation type with RB Size 1)

Undesirable emissions in 763 ~ 775 ㎒ & 793 ~ 805 ㎒ (Band 13)

Bandwidth [㎒]	Test Freq, [㎒]	RB/ Offset Size	Test Mode	Freq, [㎒]	Ant Pol [H/V]	Level [dBuV/m]	Result e.i.r.p. [dBm]	Margin [dB]	Limit [dBm]
5.0	779.5	0/1	QPSK	774.99	H	54.5	-40.7	5.7	-35.0
				795.94	V	28.9	-66.3	31.3	-35.0
	784.5	0/1	QPSK	773.30	H	35.0	-60.2	25.2	-35.0
				793.71	H	35.0	-60.2	25.2	-35.0
10.0	782	0/1	QPSK	770.60	H	36.8	-58.4	23.4	-35.0
				795.32	H	45.4	-49.8	14.8	-35.0

Note 1 : This device was tested under all modulations, RB size and RB offsets and the worst case data are reported in the table above. (The worst case mode is the QPSK modulation type with RB Size 1)

Note 2 : For part 27.53(c)(4) measurement, the FCC limit is 65 + 10log10(P[Watts])= -35dBm in a 6.25kHz bandwidth. Since it was not possible to set the resolution bandwidth to 6.25kHz with the available equipment, a bandwidth of 10kHz was used instead to show compliance. By using a 10kHz bandwidth, the result was adjusted by 10log10 (10kHz/6.25kHz) = 2.04dB.

Note 3 : No other spurious and harmonic emissions were reported greater than listed emissions above table.

Undesirable emissions in 1 559 ~ 1 610 ㎒ (Band 13)

Bandwidth [㎒]	Test Freq, [㎒]	RB/ Offset Size	Test Mode	Freq, [㎒]	Ant Pol [H/V]	Level [dBuV/m]	Result e.i.r.p. [dBm]	Margin [dB]	Limit [dBm]
5.0	779.5	0/1	QPSK	1 585.00	V	40.7	-54.5	14.5	-40.0
	784.5	0/1	QPSK	1 567.00	V	43.1	-52.1	12.1	-40.0
10.0	782	0/1	QPSK	1 570.38	V	42.3	-52.9	12.9	-40.0

Note 1 : This device was tested under all modulations, RB size and RB offsets and the worst case data are reported in the table above. (The worst case mode is the QPSK modulation type with RB Size 1 and Full RB)

Note 2 : No other spurious and harmonic emissions were reported greater than listed emissions above table.

Undesirable emissions (Band 4)

Bandwidth [㎒]	Test Freq, [㎒]	RB/ Offset Size	Test Mode	Freq, [㎒]	Ant Pol [H/V]	Level [dBuV/m]	Result e.i.r.p. [dBm]	Margin [dB]	Limit [dBm]
1.4	1 710.7	0/1	QPSK	2 111.00	H	65.5	-29.7	16.7	-13.0
				3 421.88	V	57.2	-38.0	25.0	-13.0
	1 732.5	0/1	QPSK	2 132.75	H	64.8	-30.4	17.4	-13.0
				3 465.00	V	55.2	-40.0	27.0	-13.0
	1 754.3	0/1	QPSK	2 154.50	H	65.7	-29.5	16.5	-13.0
				3 508.13	V	55.8	-39.4	26.4	-13.0
3.0	1 711.5	0/1	QPSK	2 111.75	H	68.9	-26.3	13.3	-13.0
				3 423.75	V	54.4	-40.8	27.8	-13.0
	1 732.5	0/1	QPSK	2 132.25	V	66.1	-29.1	16.1	-13.0
				3 465.00	V	53.4	-41.8	28.8	-13.0
	1 753.5	0/1	QPSK	2 152.75	H	67.5	-27.7	14.7	-13.0
				3 504.38	V	52.4	-42.8	29.8	-13.0
5.0	1 712.5	0/1	QPSK	2 112.25	H	68.7	-26.5	13.5	-13.0
				3 423.75	V	54.0	-41.2	28.2	-13.0
	1 732.5	0/1	QPSK	2 132.25	V	66.6	-28.6	15.6	-13.0
				3 466.88	V	51.8	-43.4	30.4	-13.0
	1 752.5	0/1	QPSK	2 152.25	H	67.3	-27.9	14.9	-13.0
				3 504.38	V	50.8	-44.4	31.4	-13.0
10.0	1 715.0	0/1	QPSK	2 111.50	H	68.7	-26.5	13.5	-13.0
				3 427.50	V	52.3	-42.9	29.9	-13.0
	1 732.5	0/1	QPSK	2 130.00	V	67.1	-28.1	15.1	-13.0
				3 463.13	V	50.4	-44.8	31.8	-13.0
	1 750.0	0/1	QPSK	2 146.25	H	68.0	-27.2	14.2	-13.0
				3 496.88	V	49.8	-45.4	32.4	-13.0
15.0	1 717.5	0/1	QPSK	2 121.50	H	68.7	-26.5	13.5	-13.0
				3 436.88	V	49.0	-46.2	33.2	-13.0
	1 732.5	0/1	QPSK	2 134.00	V	67.8	-27.4	14.4	-13.0
				3 463.13	V	49.7	-45.5	32.5	-13.0
	1 747.5	0/1	QPSK	2 150.25	H	68.3	-26.9	13.9	-13.0
				3 495.00	V	49.8	-45.4	32.4	-13.0
20.0	1 720.0	0/1	QPSK	2 120.50	H	68.7	-26.5	13.5	-13.0
				3 438.75	V	51.0	-44.2	31.2	-13.0
	1 745.0	0/1	QPSK	2 152.00	H	68.4	-26.8	13.8	-13.0
				3 478.13	V	47.7	-47.5	34.5	-13.0

Note 1 : This device was tested under all modulations, RB size an d RB offsets and the worst case data are reported in the table above. (The worst case mode is the QPSK modulation type with RB Size 1 and Full RB)

Note 2 : No other spurious and harmonic emissions were reported greater than listed emissions above table.

6. Test equipment used for test

	Description	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	Spectrum Analyzer	R&S	FSV40	100988	16.01.26
■	Wideband Power Sensor	R&S	NRP-Z81	102398	15.11.27
■	DC Power Supply	AGILENT	E3632A	MY40004399	16.01.06
■	Loop Antenna	R&S	HFH2-Z2	861971/003	17.03.03
■	Bi-Log Antenna	SCHWARZBECK	VULB9163	552	16.06.14
■	Horn Antenna	SCHWARZBECK	3117	155787	16.02.05
■	Horn Antenna	ETS.lindgren	3116	86632	15.10.20
■	Amplifier	SONOMA INSTRUMENT	310	293004	16.09.02
■	Emi Test Receiver	R&S	ESCI	101078	16.02.16
■	Broadband Preamplifier	SCHWARZBECK	BBV9721	2	16.05.09
■	Preamplifier	AGILENT	8449B	3008A02343	16.09.02
■	Attenuator	HP	8494A	2631A09825	15.10.14
■	Attenuator	HP	8496A	3308A16640	15.10.14
■	Highpass Filter	Wainwright Instruments GmbH	WHKX3.0/ 18G-12SS	44	16.02.02
■	Bluetooth Tester	TESCOM	TC-3000A	3000A310047	16.04.06
■	Spiral Antenna	COBHAM	PSA-75301R/170	406827-0001	-
■	Wideband Radio Communication Tester	R&S	CMW500	102572	16.10.01
■	Highpass Filter	Wainwright Instruments GmbH	WHKX1.0/ 1.5S-10SS	14	16.02.02
■	Antenna Mast	Innco Systems	MA4000-EP	-	-
■	Turn Table	Innco Systems	DT2000	-	-