

TEST REPORT



Dt&C Co., Ltd.

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1. Report No : DRTFCC2304-0049

2. Customer

- Name (FCC) : LG Electronics USA, Inc. / Name (IC) : LG ELECTRONICS INC.
- Address (FCC) : 111 Sylvan Avenue North Building Englewood Cliffs New Jersey United States 07632
Address (IC) : 222, LG-ro, Jinwi-myeon Pyeongtaek-si, Gyeonggi-do 451-713 Korea (Republic Of)

3. Use of Report : FCC & IC Class II Permissive Change

4. Product Name / Model Name : Telematics / TLVHE4IU-N

FCC ID : BEJTLVHE4IU-N

IC : 2703H-TLVHE4IUN

5. FCC Regulation(s): Part 2, 22, 24, 27

IC Standard(s): RSS-Gen Issue 5, 132 Issue 4, 133 Issue 6, 139 Issue 4

Test Method Used : KDB971168 D01v03, ANSI/TIA-603-E-2016, ANSI C63.26-2015

6. Date of Test : 2023.03.30 ~ 2023.04.04

7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

8. Testing Environment : See appended test report.

9. Test Result : Refer to attached test result.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

This test report is not related to KOLAS accreditation.

Affirmation	Tested by	Technical Manager
	Name : SeungMin Gil (Signature)	Name : JaeJin Lee (Signature)

2023 . 04 . 10 .

Dt&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description	Revised by	Revised by
DRTFCC2304-0049	Apr. 10, 2023	Initial issue	SeungMin Gil	JaeJin Lee

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1. GENERAL INFORMATION

FCC Classification	PCS Licensed Transmitter (PCB)
Product Name	Telematics
Model Name	TLVHE4IU-N
Add Model Name	-
FVIN(Firmware Version Identification Number)	0686
EUT Serial Number	232VHKR000012
Supplying power	DC 12 V
Antenna Information	Antenna Type: Shark pin antenna (Model : 5WA.035.507.C 041)

	Antenna gain (dBi)	Cable loss(dB)	Antenna gain including connected cable loss between transmitter and antenna (dBi)
Band 850	1.49	-5.0	-3.51
Band 1700	-0.20	-7.4	-7.60
Band 1900	1.04	-7.7	-6.66

Mode	Tx Frequency (MHz)	ERP (Max. Power)		EIRP (Max. Power)	
		dBm	W	dBm	W
GPRS850	824.2 ~ 848.8	24.25	0.266	-	-
EDGE850	824.2 ~ 848.8	17.78	0.060	-	-
WCDMA850	826.4 ~ 846.6	14.84	0.030	-	-
WCDMA1700	1 712.4 ~ 1 752.6	-	-	15.55	0.036
GPRS1900	1 850.2 ~ 1 909.8	-	-	22.57	0.181
EDGE1900	1 850.2 ~ 1 909.8	-	-	18.33	0.068
WCDMA1900	1 852.4 ~ 1 907.6	-	-	15.55	0.036

2. INTRODUCTION

2.1. EUT DESCRIPTION

The Equipment Under Test (EUT) supports 850/1900 GPRS, 850/1700/1900 WCDMA, Multi-band LTE.

2.2. TESTING ENVIRONMENT

Ambient Condition	
▪ Temperature	+22 °C ~ +24 °C
▪ Relative Humidity	41 % ~ 43 %

2.3. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

2.4. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.

Parameter	Measurement uncertainty
Radiated Disturbance (Below 1 GHz)	4.8 dB (The confidence level is about 95 %, $k = 2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.0 dB (The confidence level is about 95 %, $k = 2$)
Radiated Disturbance (Above 18 GHz)	5.2 dB (The confidence level is about 95 %, $k = 2$)

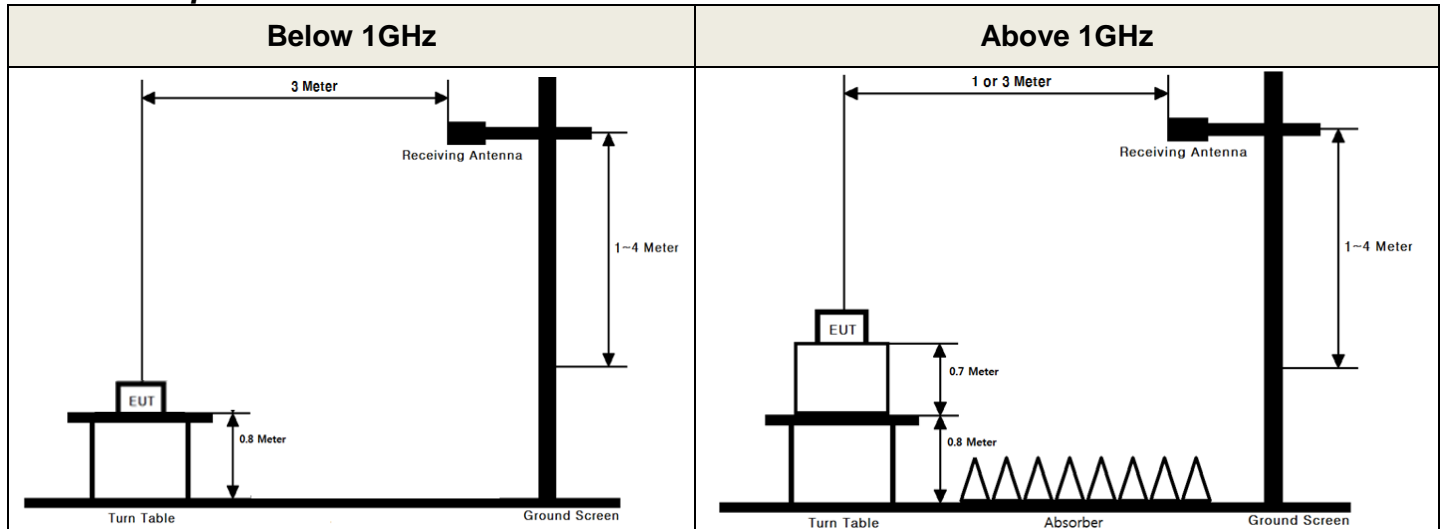
2.5. TEST FACILITY

Dt&C Co., Ltd.		
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042.		
The test site complies with the requirements of § 2.948 according to ANSI C63.4-2014.		
- FCC & IC MRA Designation No. : KR0034		
- ISSED #: 5740A		
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3. DESCRIPTION OF TESTS

3.1 ERP & EIRP (Effective Radiated Power & Equivalent Isotropic Radiated Power)

Test Set-up



These measurements were performed at 3 m test site. The equipment under test is placed on a non-conductive table 0.8 or 1.5 meters above a turntable which is flush with the ground plane and 3 meters from the receive antenna. For measurements above 1 GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.

Test Procedure

- ANSI/TIA-603-E-2016 - Section 2.2.17
- KDB971168 D01v03 - Section 5.2.2
- ANSI 63.26-2015 – Section 5.2.4.4.1

Test setting

1. Set span to 2 x to 3 x the OBW.
2. Set RBW = 1% to 5% of the OBW.
3. Set VBW \geq 3 x RBW.
4. Set number of points in sweep \geq 2 x span / RBW.
5. Sweep time:
 - 1) Set = auto-couple, or
 - 2) Set \geq $[10 \times (\text{number of points in sweep}) \times (\text{transmission period})]$ for single sweep (automation-compatible) measurement. Transmission period is the on and off time of the transmitter.
6. Detector = power averaging (rms).
7. If the EUT can be configured to transmit continuously, then set the trigger to free run.
8. If the EUT cannot be configured to transmit continuously, then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Verify that the sweep time is less than or equal to the transmission burst duration. Time gating can also be used under similar constraints (i.e., configured such that measurement data is collected only during active full-power transmissions).

9. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over multiple symbols, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.
10. Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

The receiver antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer.

A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminal of the substitute antenna is measured.

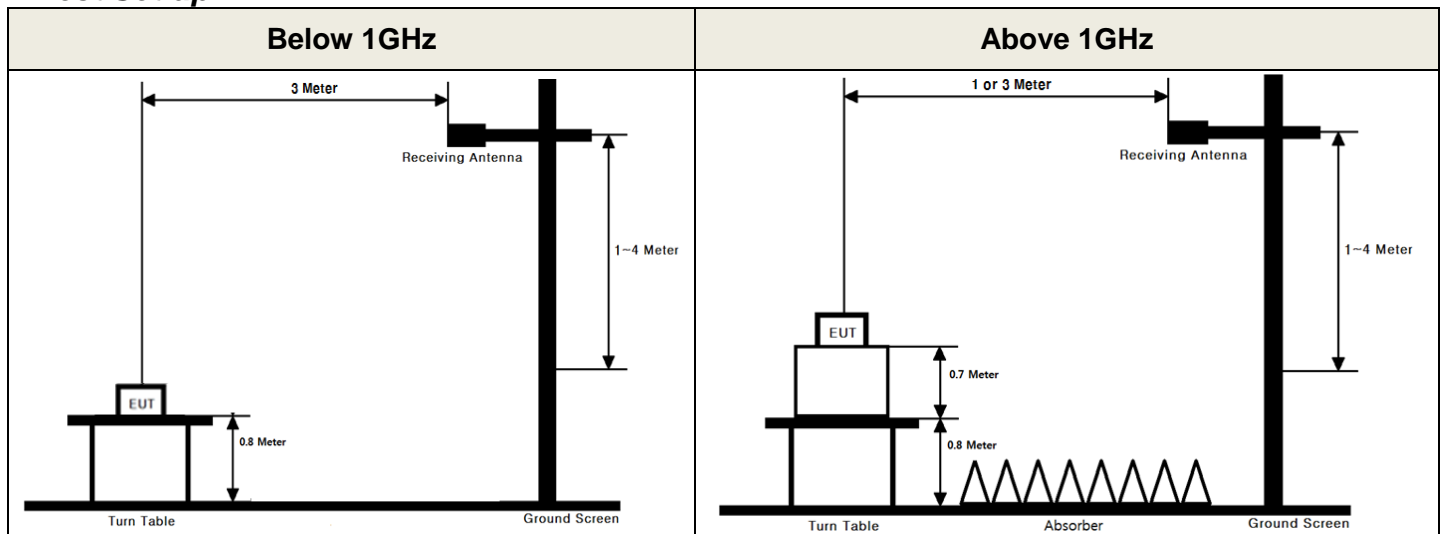
The ERP/EIRP is calculated using the following formula:

ERP/EIRP = The conducted power at the substitute antenna's terminal [dBm] + Substitute Antenna gain [dBd for ERP, dBi for EIRP]

For readings above 1 GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn antenna and an isotropic antenna are taken into consideration.

3.2 RADIATED SPURIOUS EMISSIONS

Test Set-up



These measurements were performed at 3 m test site. The equipment under test is placed on a non-conductive table 0.8 or 1.5 meters above a turntable which is flush with the ground plane and 3 meters from the receive antenna. For measurements above 1 GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.

Test Procedure

- ANSI/TIA-603-E-2016 - Section 2.2.12
- KDB971168 D01v03 - Section 5.8
- ANSI C63.26-2015 - Section 5.5

Test setting

1. RBW = 100 kHz for below 1 GHz and 1 MHz for above 1 GHz / VBW $\geq 3 \times$ RBW
2. Detector = RMS & Trace mode = Max hold
3. Sweep time = Auto couple
4. Number of sweep point $\geq 2 \times$ span / RBW
5. The trace was allowed to stabilize

The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer.

For radiated spurious emission measurements below 1 GHz, a half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading.

For radiated spurious emission measurements above 1 GHz, a Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading. The difference between the gain of the horn and an isotropic antenna are taken into consideration.

4. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal. Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	22/06/24	23/06/24	US47360812
Radio Communication Analyzer	Agilent Technologies	E5515C	22/12/16	23/12/16	MY48360842
Thermohygrometer	BODYCOM	BJ5478	22/12/16	23/12/16	120612-2
Signal Generator	Rohde Schwarz	SMBV100A	22/12/16	23/12/16	255571
Signal Generator	ANRITSU	MG3695C	22/12/16	23/12/16	173501
Loop Antenna	ETS-Lindgren	6502	22/12/16	24/12/16	00226186
BILOG ANTENNA	Schwarzbeck	VULB9160	22/12/16	23/12/16	3362
Dipole Antenna	Schwarzbeck	UHA9105	22/12/16	24/12/16	2262
HORN ANT	ETS	3117	22/12/16	23/12/16	00140394
HORN ANT	A.H.Systems	SAS-574	22/06/24	23/06/24	155
PreAmplifier	H.P	8447D	22/12/16	23/12/16	2944A07774
PreAmplifier	Agilent	8449B	22/06/24	23/06/24	3008A02108
PreAmplifier	tsj	MLA-1840-J02-45	22/06/24	23/06/24	16966-10728
High Pass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	22/06/24	23/06/24	7
High Pass Filter	Wainwright Instruments	WHKX10-2838-3300-18000-60SS	22/06/24	23/06/24	2
High Pass Filter	Wainwright Instruments	WHKX6-6320-8000-26500-40CC	22/06/24	23/06/24	2
Cable	HUBER+SUHNER	SUCOFLEX100	23/01/04	24/01/04	M-01
Cable	HUBER+SUHNER	SUCOFLEX100	23/01/04	24/01/04	M-02
Cable	JUNKOSHA	MWX241/B	23/01/04	24/01/04	M-03
Cable	JUNKOSHA	MWX221	23/01/04	24/01/04	M-04
Cable	JUNKOSHA	MWX221	23/01/04	24/01/04	M-05
Cable	DTNC	Cable	23/01/04	24/01/04	M-06
Cable	JUNFLON	J12J101757-00	23/01/04	24/01/04	M-07
Cable	HUBER+SUHNER	SUCOFLEX104	23/01/04	24/01/04	M-08
Cable	HUBER+SUHNER	SUCOFLEX106	23/01/04	24/01/04	M-09
Cable	JUNKOSHA	MWX241	23/01/03	24/01/03	mmW-1
Cable	JUNKOSHA	MWX241	23/01/03	24/01/03	mmW-4

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

Note2: The cable is not a regular calibration item, so it has been calibrated by Dt&C itself.

5. SUMMARY OF TEST RESULTS

FCC Part Section(s)	RSS Section(s)	Parameter	Status Note 1
22.913(a) 24.232(c) 27.50(d.4)	RSS-132 [5.4] RSS-133 [6.4] RSS-139 [5.5]	Effective Radiated Power Equivalent Isotropic Radiated Power	C Note2
2.1053 22.917(a) 24.238(a) 27.53(h)	RSS-132 [5.5] RSS-133 [6.5] RSS-139 [5.6]	Radiated Spurious and Harmonic Emissions	C Note2
<p>Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable</p> <p>Note 2: This test item was performed in three orthogonal EUT positions and the worst case data was reported.</p>			

6. EMISSION DESIGNATOR AND SAMPLE CALCULATION

A. For substitution method

- 1) The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1 GHz respectively above ground.
- 2) The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
- 3) During the test, the turn table is rotated until the maximum signal is found.
- 4) Record the field strength meter's level. (ex. Spectrum reading level is -8.5 dBm)
- 5) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 6) Increase the signal generator output till the field strength meter's level is equal to the item (4).
(ex. Signal generator level is -18.04 dBm)
- 7) The gain of the cable and amplifier between the signal generator and terminals of substituted antenna is 46.92 dB at test frequency.
- 8) Record the level at substituted antenna terminal. (ex. 28.88dBm)
- 9) The result is calculated as below;

$$\text{EIRP(dBm)} = \text{LEVLE@ANTENNA TERMINAL} + \text{TX Antenna Gain (dBi)}$$

$$\text{ERP(dBm)} = \text{LEVLE@ANTENNA TERMINAL} + \text{TX Antenna Gain (dBd)}$$

$$\text{Where, TX Antenna Gain (dBd)} = \text{TX Antenna Gain (dBi)} - 2.15 \text{ dB}$$

7. TEST DATA

7.1 EFFECTIVE RADIATED POWER

- Test Notes

This EUT was tested under all configurations and the highest power is reported in GSM mode and WCDMA mode with HSDPA inactive at 12.2 kbps RMC and TPC bits set to "1" and in GSM mode using a Power Control Level of "0" in PCS Band and "5" in the Cellular Band. The worst case data is reported.

- GSM850 data

Mode	Frequency (MHz)	Ant Pol(H/V)	Level at Antenna Terminal (dBm)	Substitute Antenna Gain(dBd)	ERP (dBm)	ERP (W)	Note.
GSM850	824.2	H	24.85	-0.60	24.25	0.266	1TX
GSM850	836.6	H	24.40	-0.65	23.75	0.237	1TX
GSM850	848.8	H	24.36	-0.70	23.66	0.232	1TX
EDGE850	824.2	H	18.38	-0.60	17.78	0.060	1TX

- WCDMA850 data

Mode	Frequency (MHz)	Ant Pol(H/V)	Level at Antenna Terminal (dBm)	Substitute Antenna Gain(dBd)	ERP (dBm)	ERP (W)	Note.
WCDMA850	826.4	H	13.92	-0.61	13.31	0.021	-
WCDMA850	836.6	H	15.49	-0.65	14.84	0.030	-
WCDMA850	846.6	H	13.38	-0.69	12.69	0.019	-

7.2 EQUIVALENT ISOTROPIC RADIATED POWER

- Test Notes

This EUT was tested under all configurations and the highest power is reported in GSM mode and WCDMA mode with HSDPA inactive at 12.2 kbps RMC and TPC bits set to "1" and in GSM mode using a Power Control Level of "0" in PCS Band and "5" in the Cellular Band. The worst case data is reported.

- WCDMA1700 data

Mode	Frequency (MHz)	Ant Pol(H/V)	Level at Antenna Terminal (dBm)	Substitute Antenna Gain(dBi)	EIRP (dBm)	EIRP (W)	Note.
WCDMA1700	1 712.4	V	9.64	5.91	15.55	0.036	-
WCDMA1700	1 732.4	V	9.61	5.69	15.30	0.034	-
WCDMA1700	1 752.6	V	8.37	5.47	13.84	0.024	-

- GSM1900 data

Mode	Frequency (MHz)	Ant Pol(H/V)	Level at Antenna Terminal (dBm)	Substitute Antenna Gain(dBi)	EIRP (dBm)	EIRP (W)	Note.
GSM1900	1 850.2	V	17.81	4.76	22.57	0.181	1TX
GSM1900	1 880.0	V	17.47	4.56	22.03	0.160	1TX
GSM1900	1 909.8	V	16.59	4.45	21.04	0.127	1TX
EDGE1900	1 850.2	V	13.57	4.76	18.33	0.068	1TX

- WCDMA1900 data

Mode	Frequency (MHz)	Ant Pol(H/V)	Level at Antenna Terminal (dBm)	Substitute Antenna Gain(dBi)	EIRP (dBm)	EIRP (W)	Note.
WCDMA1900	1 852.4	V	10.81	4.74	15.55	0.036	-
WCDMA1900	1 880.0	V	10.89	4.56	15.45	0.035	-
WCDMA1900	1 907.6	V	10.44	4.44	14.88	0.031	-

7.3 RADIATED SPURIOUS EMISSIONS

- Test Notes

1. This EUT was tested under all configurations and the highest power is reported in GSM mode and WCDMA mode with HSDPA inactive at 12.2 kbps RMC and TPC bits set to "1" and in GSM mode using a Power Control Level of "0" in PCS Band and "5" in the Cellular Band. The worst case data is reported.
2. No other spurious and harmonic emissions were reported greater than listed emissions.
3. Limit = -13dBm

- GSM850 data

Tx Freq. (MHz)	Freq. (MHz)	Ant Pol (H/V)	Level at Antenna Terminal(dBm)	Substitute Antenna Gain(dBd)	Correct Generator Level(dBm)	Limit (dBm)	Margin (dB)	Note
824.2	1 648.43	V	-41.66	4.04	-37.62	-13.00	24.62	-
	2 472.56	V	-51.06	3.70	-47.36	-13.00	34.36	-
	3 296.69	V	-53.87	5.48	-48.39	-13.00	35.39	-
	4 120.63	V	-50.85	6.99	-43.86	-13.00	30.86	-
836.6	1 673.10	V	-43.02	3.98	-39.04	-13.00	26.04	-
	2 509.94	V	-35.12	3.58	-31.54	-13.00	18.54	-
	3 346.27	V	-52.31	5.57	-46.74	-13.00	33.74	-
	4 183.23	V	-51.83	7.10	-44.73	-13.00	31.73	-
848.8	1 697.60	V	-41.67	3.91	-37.76	-13.00	24.76	-
	2 546.37	V	-34.98	3.86	-31.12	-13.00	18.12	-
	3 395.19	V	-53.00	5.75	-47.25	-13.00	34.25	-
	4 243.70	V	-54.01	7.17	-46.84	-13.00	33.84	-

- WCDMA850 data

Tx Freq. (MHz)	Freq. (MHz)	Ant Pol (H/V)	Level at Antenna Terminal(dBm)	Substitute Antenna Gain(dBd)	Correct Generator Level(dBm)	Limit (dBm)	Margin (dB)	Note
826.4	1 650.48	V	-54.70	4.04	-50.66	-13.00	37.66	-
	2 482.85	V	-50.95	3.62	-47.33	-13.00	34.33	-
836.6	1 671.41	V	-54.57	3.98	-50.59	-13.00	37.59	-
	2 510.06	V	-48.21	3.58	-44.63	-13.00	31.63	-
846.6	1 691.24	V	-55.68	3.92	-51.76	-13.00	38.76	-
	2 539.68	V	-50.28	3.81	-46.47	-13.00	33.47	-

- WCDMA1700 data

Tx Freq. (MHz)	Freq. (MHz)	Ant Pol (H/V)	Level at Antenna Terminal(dBm)	Substitute Antenna Gain(dBi)	Correct Generator Level(dBm)	Limit (dBm)	Margin (dB)	Note
1 712.4	3 425.59	V	-57.00	8.00	-49.00	-13.00	36.00	-
1 732.4	3 463.46	V	-56.59	8.12	-48.47	-13.00	35.47	-
1 752.6	3 506.83	V	-57.12	8.23	-48.89	-13.00	35.89	-

- GSM1900 data

Tx Freq. (MHz)	Freq. (MHz)	Ant Pol (H/V)	Level at Antenna Terminal(dBm)	Substitute Antenna Gain(dBi)	Correct Generator Level(dBm)	Limit (dBm)	Margin (dB)	Note
1 850.2	3 700.32	V	-48.88	8.21	-40.67	-13.00	27.67	-
	5 550.76	V	-36.50	10.18	-26.32	-13.00	13.32	-
1 880.0	3 759.94	V	-41.63	8.27	-33.36	-13.00	20.36	-
	5 640.18	V	-31.38	10.25	-21.13	-13.00	8.13	-
1 909.8	3 819.47	V	-48.34	8.42	-39.92	-13.00	26.92	-
	5 729.25	V	-38.24	10.33	-27.91	-13.00	14.91	-

- WCDMA1900 data

Tx Freq. (MHz)	Freq. (MHz)	Ant Pol (H/V)	Level at Antenna Terminal(dBm)	Substitute Antenna Gain(dBi)	Correct Generator Level(dBm)	Limit (dBm)	Margin (dB)	Note
1 852.4	3 706.83	V	-55.00	8.21	-46.79	-13.00	33.79	-
	5 553.68	V	-56.85	10.18	-46.67	-13.00	33.67	-
1 880.0	3 761.84	V	-52.96	8.27	-44.69	-13.00	31.69	-
	5 643.75	V	-43.00	10.25	-32.75	-13.00	19.75	-
1 907.6	3 817.00	V	-52.86	8.41	-44.45	-13.00	31.45	-
	5 719.59	V	-55.43	10.33	-45.10	-13.00	32.10	-