

User Guide for LTD-VH1000 (Eagle)

PRODUCT : CDMA/EVDO WIRELESS MODEM

MODEL NAME : LTD-VH1000

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1. Overview

The LTD-VH1000 is achieved as personal mobile communication devices of the compact radio equipment, the latest design of the parts becoming smaller, lighter weight having the 850/1900MHz bands. It is the vehicle's telematics system that connect with CDMA(EVDO) wireless network and the wireless module with voice and data communication. It can be operated at land, rivers, and other similar areas. On EVDO operating mode, It can be communicated with uplink 1.8Mbps, downlink up to 3.1Mbps data transfer speed such as a movie or a video call. It may be able to receive large amounts of data.

Standard RS-232 port and USB port communicating with the host system via AT-command or control commands can be used to send data. Voice calls are possible

1.1. Product description

The LTD-VH1000 module described in this manual is supported CDMA 1x (EVDO rev.A) connectivity to HYUNDAI TCU(Telecommunication control unit) This module is manufactured by LG INNOTEK and installed by HYUNDAI

1.2. Block diagram

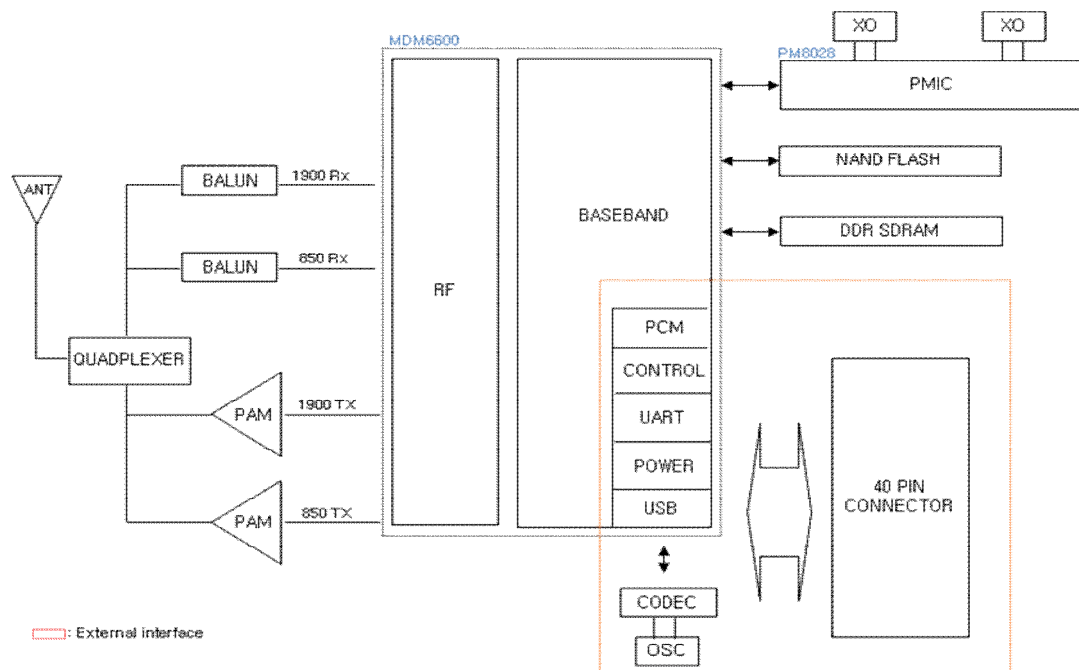


Figure 1 Block Diagram

2. Major Features

Mechanical	Dimension	<ul style="list-style-type: none"> 38.4 (W) x 92 (L) x 7.6 (T) mm
	Interface	<ul style="list-style-type: none"> USB, UART, General Purpose I/O pins
	Antenna	<ul style="list-style-type: none"> FAKRA Connector
	Temperature *	<ul style="list-style-type: none"> Operation : -20 °C ~ +70 °C Storage : -40 °C ~ +85 °C
CDMA	Main Chipset	<ul style="list-style-type: none"> MDM 6600
	Memory	<ul style="list-style-type: none"> 512Mb(NAND) / 256Mb(SDRAM)
	Standard	<ul style="list-style-type: none"> 3GPP2 CDMA 1X, EVDO Rev.A <ul style="list-style-type: none"> - DL Speed : 3.1 Mbps - UL Speed : 1.8 Mbps
	Band	<ul style="list-style-type: none"> CDMA 850(DCN), 1900 (PCS) GPS(Not supported)
	Power	<ul style="list-style-type: none"> Max. 24dBm (Power Class 3)
Etc.	OS	<ul style="list-style-type: none"> Android 2.3
	DC Power	<ul style="list-style-type: none"> 3.8V
	Functions	<ul style="list-style-type: none"> Voice, Data, SMS

2.1 Automotive Parts

No	Item	Manufacturer	Operating Temperature/ Note
1	MDM6600	Qualcomm	-20~ 85℃
2	PAM	AVARGO	-30 ~ 85℃
3	Filter	EPCOS	-20~+85℃
4	Quadplexer	AVARGO	-20~+85℃
5	MEMORY(NAND)	NUMONYX	Automotive Part
6	MEMORY(SDRAM_DDR)	MICRON	Automotive Part
7	Capacitor / Inductor	Murata	Automotive Part
8	Resistor	YAGEO	Automotive Part
9	TCXO	KDS	Automotive Part
10	PCB	LGIT	6 Layer

3. Interface

3.1. Pin outs

Customer P/N is connected with outer device using 40 pin connectors

NC	1	2	NC
NC	3	4	NC
GPIO(NC)	5	6	GPIO(NC)
GPIO(NC)	7	8	GPIO(NC)
GPIO(NC)	9	10	GPIO(NC)
BOOT_OK	11	12	MSG
NC	13	14	GPIO(NC)
NC	15	16	PCM_3.3V_TXD
NC	17	18	PCM_3.3V_RXD
PCM_3.3V_CLK	19	20	PCM_3.3V_SYNC
GND	21	22	GND
MIC+	23	24	MIC-
SPK+	25	26	SPK-
48H_END	27	28	RESET_IN-
USB_VBUS	29	30	ACC(POWER_ON)
V_BATT	31	32	V_BATT
GND	33	34	GND
USB_D+	35	36	USB_D-
TXD2	37	38	NC
RXD2	39	40	GND

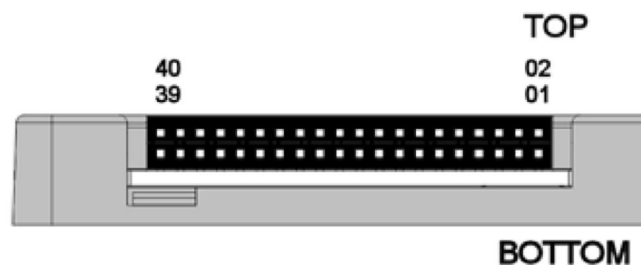


Figure 2 Modem Interface Connector Pin arrangement

3.2. Pin Descriptions

	Pin NO.	Signal Name	In/Out	기능
NC	1, 2, 3, 4, 13, 15, 17, 38	NC		
V_BATT	31, 32	POWER		POWER
GND	21, 22, 33, 34, 40	GND		GND
PCM	16	PCM_3.3V_TXD	O	PCM DATA OUT
	18	PCM_3.3V_RXD	I	PCM DATA IN
	19	PCM_3.3V_CLK	O	PCM CLK
	20	PCM_3.3V_SYNC	O	PCM SYNC
UART2	37	TXD2	I	Serial Data Input 2, HSDPA 디버깅
(DM Port)	39	RXD2	O	Serial Data Output 2, HSDPA 디버깅
USB (USB2.0)	29	USB_VBUS	I	Power supply for the USB transceiver
	35	USB_D+	I/O	USB differential data (+)
	36	USB_D-	I/O	USB differential data (-)
AUDIO (MIC/SPK)	23	MIC+	I	Differential Microphone input (+)
	24	MIC-	I	Differential Microphone input (-)
	25	SPK+	O	Analog Audio Differential Output (+)
	26	SPK-	O	Analog Audio Differential Output (-)
User Interface	9	SSIO	I	Air-bag Signal input(Not use)
	10	SSI1	I	CAN Wake Up Signal input (Not use)
	11	BOOT_OK	O	Modem Booting Completion / Modem Wake Up
	12	MSG	O	Received emergency message from Center
	14	AUDIO_ON-	O	Signified in voice communication(not use)
	27	48H_END	O	Signified in 48 hours standby mode ending
	28	RESET_IN-	I	Modem Hardware reset input
	30	ACC(POWER_ON)	I	Modem Power ON/ Modem POWER Sleep
GPIO	5, 6, 7, 8, 9, 10, 14	GPIO	I/O	Possible to connect to GPIO/

Table 1 Pin Descriptions

3.3. UART (RS-232 Interface)

This module is provided with interface supporting Standard RS-232 protocol.

DCE(modem) is exchanged with data or control AT-Command through DTE(host).

Pin NO.	Signal Name	Function (Modem)	Pin Function Summary
37	TXD2	I	Serial Data Input 2
39	RXD2	O	Serial Data output 2

3.4. USB

It is supported with universal serial bus for high data communication.

It is satisfied with USB2.0 specification and supported with Max.480Mbps

Pin NO.	Signal Name	Function (Modem)	Pin Function Summary
29	USB_VBUS	I	Power supply for the USB transceiver
35	USB_D+	I/O	USB differential data (+)
36	USB_D-	I/O	USB differential data (-)

3.5. AUDIO

Modem is provided with condenser mic input, speaker output for voice call

Speaker output can connect with 32Ω speaker

Pin NO.	Signal Name	Function (Modem)	Pin Function Summary
23	MIC+	I	Differential Microphone input (+)
24	MIC-	I	Differential Microphone input (-)
25	SPK+	O	Analog Audio Differential Output(+)
26	SPK-	O	Analog Audio Differential Output (-)

3.6. User Interface Signals

Pin NO.	Signal Name	Function (Modem)	Pin Function Summary
9	GPIO		NC
10	GPIO		NC
11	BOOT_OK	O	Modem booting end / Modem Wake Up
12	MSG	O	Received emergency message from center
14	GPIO		NC
27	48H_END	O	Signified in 48 hours standby mode ending
28	RESET_IN-	I	Modem Hardware reset input
30	ACC(POWER_ON)	I	Modem Power ON/Modem POWER Sleep

3.7. PCM Signals

Pin NO.	Signal Name	Function (Modem)	Pin Function Summary
16	PCM_3.3V_TXD	O	PCM DATA OUT
18	PCM_3.3V_RXD	I	PCM DATA IN
19	PCM_3.3V_CLK	O	PCM CLOCK
20	PCM_3.3V_SYNC	O	PCM SYNC

4. Electrical Specifications

4.1. Power Supply Specification

Modem power(V_BATT) should be provided DC3.8V \pm 0.1V, 1.5A. Modem power is provided according to inner function and per block using DC regulated circuit. It is controlled with each power depending on the mechanism to reduce power consumption to a minimum. PA is used directly V_BATT because of a lot of power input power source. Thus, It can be resulted in breakage of PA in excess of the rated input power.

In addition, surge and ESD should be designed to block the influx in order to prevent damage to the modem.

Pin NO.	Signal Name	Function (Modem)	MIN	TYP	MAX
31,32	V_BATT	I	3.7V	3.8V	3.9V

4.2. Logic Level Specifications

4.2.1. Digital logic level specifications

Basic interface level : CMOS 1.8V, 2.85V

Parameter	Comments	Min	Typ	Max	Unit	
V _{IH}	High-level input voltage	0.65·V _{DD_PX}	–	V _{DD_PX} +0.3	V	
V _{IL}	Low-level input voltage	-0.3	–	0.35·V _{DD_PX}	V	
V _{SHYS}	Schmitt hysteresis voltage	100	–	–	mV	
I _{IH}	Input high leakage current ^{1 2}	No pull-down	–	1	μA	
I _{IL}	Input low leakage current ^{1 2}	No pull-up	-1	–	μA	
I _{IHPD}	Input high leakage current ^{1 3}	With pull-down	3	30	μA	
I _{ILPU}	Input low leakage current ^{2 3}	With pull-up	-30	-3	μA	
V _{OH}	High-level output voltage ⁴	CMOS, at pin rated drive strength	V _{DD_PX} -0.45	–	V _{DD_PX}	V
V _{OL}	Low-level output voltage ⁴	CMOS, at pin rated drive strength	0	–	0.45	V
I _{OZH}	Tri-state leakage current ¹	Logic high output, no pull down	–	1	μA	
I _{OZL}	Tri-state leakage current ²	Logic low output, no pull up	-1	–	μA	
I _{OZHPD}	Tri-state leakage current ^{1 3}	Logic high output with pull-down	5	30	μA	
I _{OZLPU}	Tri-state leakage current ^{2 3}	Logic low output with pull-up	-30	-5	μA	
I _{OZHKP}	Tri-state leakage current ^{1 3}	Logic high output with keeper	-15	-3	μA	
I _{OZLKP}	Tri-state leakage current ^{2 3}	Logic low output with keeper	3	15	μA	
I _{ISL}	Sleep crystal input leakage		-0.15	0.15	μA	
I _{IHVKP}	High V tolerant input leakage	With keeper	-1	–	μA	
C _{IN}	Input capacitance ⁵		–	7	pF	

5. RF Specifications

5.1. Receiver

- Bandwidth: 1.25MHz
- Frequency: 869MHz – 894MHz(BC0), 1930MHz – 1990MHz(BC1)
- RF to Baseband Direct conversion(Zero IF)
- Modulation method : QPSK,8PSK and 16QAM
- Sensitivity: -104dBm under (BER = 0.5%under)

5.2. Transceiver

- Frequency : 824MHz – 849MHz(BC0), 1850MHz – 1910MHz(BC1)
- Maximum RF Output: Power class3(BC0) Power class2(BC1), 23.01dBm ~ 30dBm max.
- Modulation method: BPSK, QPSK AND 8PSK
- Baseband to RF Direct conversion(Zero IF)

6. Mechanical Specification

6.1. Mechanical Dimensions

Dimensions	92.0 x 38.4 x 7.6 mm
Weight	30.7 grams max.
Modem Interface connector	KM17E-40DS (manufacturer : HIROSE)
Antenna Connector	59S21B-40MT5-D (manufacturer : Rosenberger)

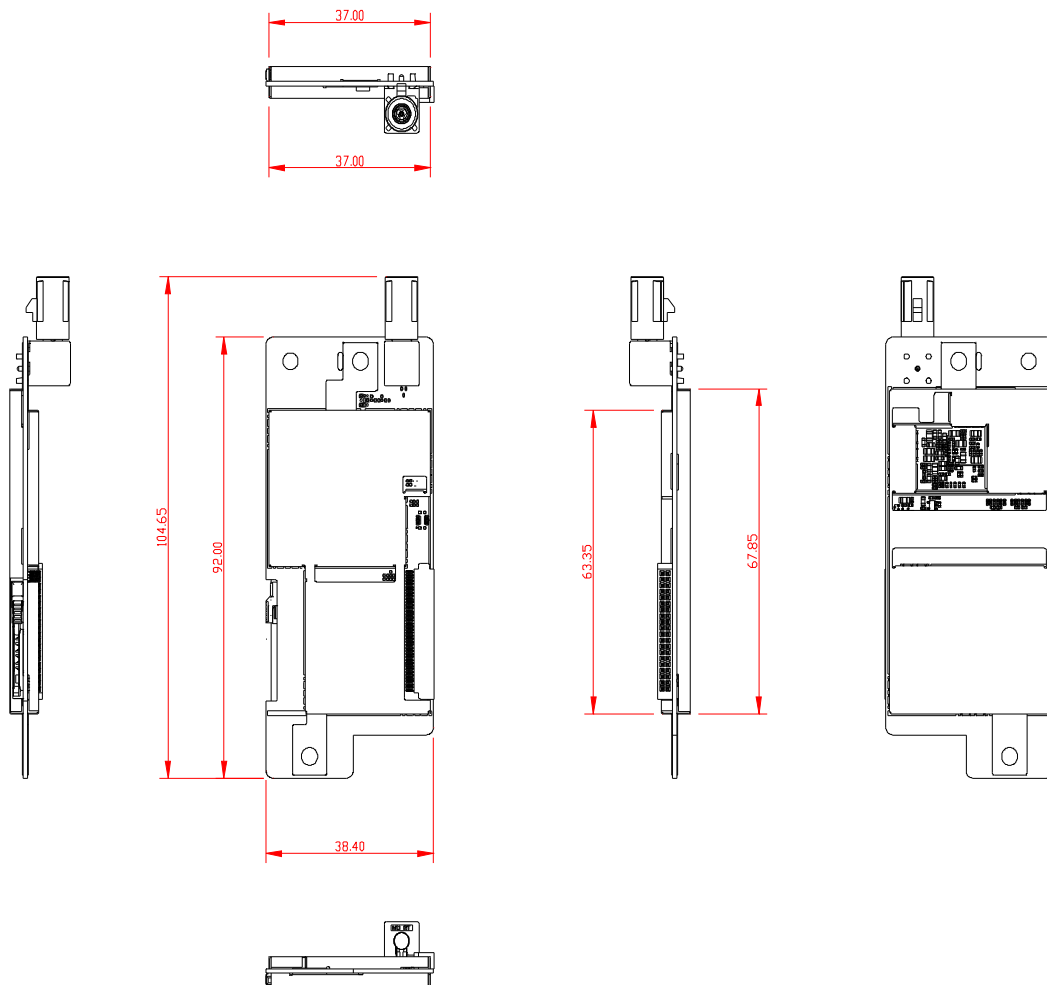


Figure 3 Mechanical Dimension

6.2. Environmental Specifications

- 1) Storage Temp : $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$
- 2) Operating Temp : $-20^{\circ}\text{C} \sim +70^{\circ}\text{C}$
 - ($-20^{\circ}\text{C} \sim +70^{\circ}\text{C}$: 3GPP specifications satisfaction
 - $-30^{\circ}\text{C} \sim -20^{\circ}\text{C}$, $+70^{\circ}\text{C} \sim +80^{\circ}\text{C}$: can be performance degradation
- 3) Operating humidity : 90% (50°C) relative humidity
- 4) Operating vibration : 5 Hz \sim 500 Hz Sine wave 1.5G

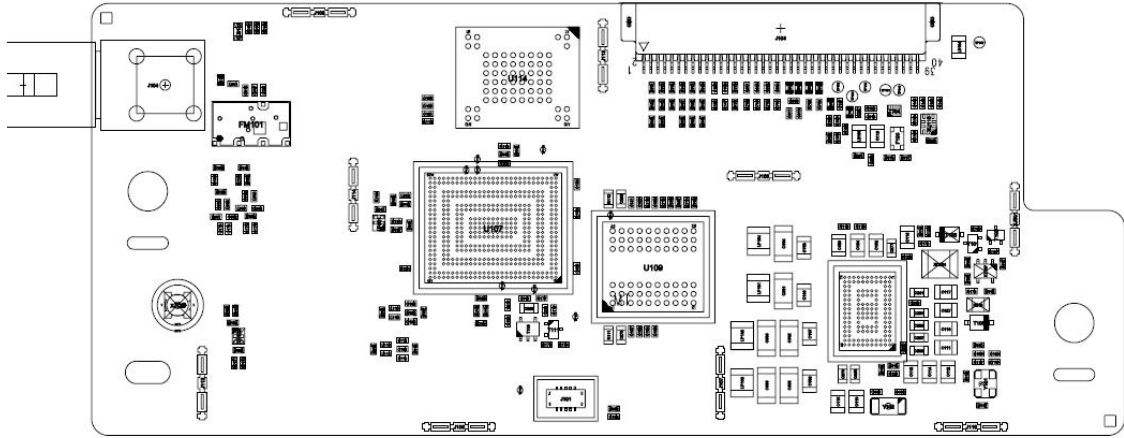
7. General Specification

7.1. CDMA Electrical Specification

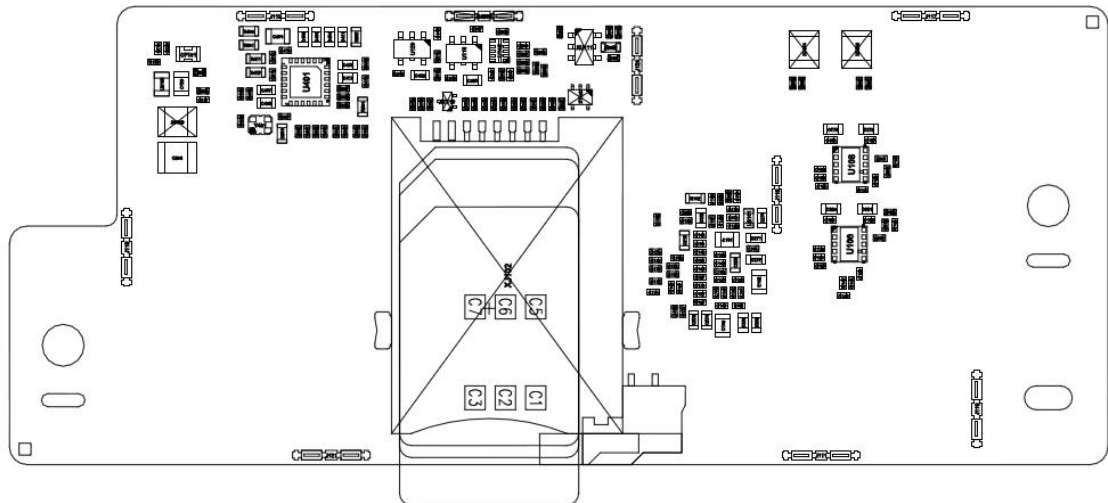
CH(850MHz/1900MHz)

	시험 항목	Spec.	CHANNEL		
			1017/25	358/563	774/1175
4.4.5	Maximum Output Power	23.01~30dBm			
4.5.1	Conducted Spurious Emissions				
	885 kHz to 1.98 MHz	-42 dBc↓/30 kHz			
	1.98 MHz to 4.00 MHz	-54 dBc↓/30 kHz (BC0) -50 dBc↓/30 kHz (BC1)			
4.4.6	Minimum Controlled Output Power	-50dBm↓			
4.3.4	Waveform Quality				
	Rho	0.94 ~1.00			
	Freq_E	+/-300.00Hz(BC0) +/-150.00Hz(BC1)			
	Time_E	-1.00~1.00 us			
4.4.9	Code Channel to Reverse Pilot Channel Output Power Accuracy				
	Data Rate: 9600 bps	3.5~4 dB			
4.4.4	Range of Closed Loop Power Control				
	up @ Full rate	24↑			
	down @ Full Rate	-24↓			
	up @ Half rate	24↑			
	down @ Half Rate	-24↓			
	up @ Quarter rate	24↑			
	down @ Quarter Rate	-24↓			
	up @ Eighth rate	24↑			
	down @ Eighth Rate	-24↓			
4.4.2	Time Response of Open Loop Control	PASS			
4.4.1	Range of Open Loop Power				
	Open Loop Power Upper	-57.50~-38.50(BC0) -60.50~-41.50(BC1)			
	Open Loop Power Mid	-17.50~-1.50(BC0) -20.50~-1.50(BC1)			
	Open Loop Power Sense	10.50~29.50(BC0) 10.50~29.50(BC1)			
4.3.2	Reverse Pilot Channel to Code Channel Time Tolerance	±10 ns.			
4.3.3	Reverse Pilot Channel to Code Channel Phase Tolerance	0.05~0.15 deg			
4.3.4	HWQ				
	Rho	0.94~1.00			
	Freq_E	+/-300.00Hz(BC0) +/-150.00Hz(BC1)			
	Time_E	-1.00~1.00 us			
3.5.1	Reference Sensitivity Level(-104/-25)	0.5% ↓			

8.Parts Map



Top



Bottom

9. Connector

9.1. Antenna Connector : 59S21B-40MT5_D(manufacturer : Rosenberger)

TECHNICAL DATA SHEET	Rosenberger®																
FAKRA - HF PLUG FOR PCB	59S21B-40MT5-Y																
<p>All dimensions are in mm; tolerances according to ISO 2768 m-H Y = Part number has to be accomplished by codification</p>																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;"></th> <th colspan="4" style="text-align: center;">Masse / dimensions (mm)</th> </tr> <tr> <th style="text-align: left;">Bereich / range</th> <th style="text-align: center;">0 bis/ to 0.5</th> <th style="text-align: center;">0.5 bis/ to 3</th> <th style="text-align: center;">3 bis/ to 6</th> <th style="text-align: center;">6 bis/ to 30</th> </tr> </thead> <tbody> <tr> <td style="text-align: left;">Toleranz / Tolerance (mm)</td> <td style="text-align: center;">± 0.05 *)</td> <td style="text-align: center;">± 0.1</td> <td style="text-align: center;">± 0.1</td> <td style="text-align: center;">± 0.2</td> </tr> </tbody> </table>				Masse / dimensions (mm)				Bereich / range	0 bis/ to 0.5	0.5 bis/ to 3	3 bis/ to 6	6 bis/ to 30	Toleranz / Tolerance (mm)	± 0.05 *)	± 0.1	± 0.1	± 0.2
	Masse / dimensions (mm)																
Bereich / range	0 bis/ to 0.5	0.5 bis/ to 3	3 bis/ to 6	6 bis/ to 30													
Toleranz / Tolerance (mm)	± 0.05 *)	± 0.1	± 0.1	± 0.2													
<p>*) Angabe abweichend zu / Indication deviant to DIN ISO 2768 m-H</p>																	
<p>Interface</p>																	
<p>According to</p>		<p>DIN 72594-1, USCAR 17</p>															
<p>Documents</p>																	
<p>PCB layout</p>		<p>MB_281</p>															
<p>Assembly instruction</p>		<p>MA_59V092</p>															
<p>Rosenberger Hochfrequenztechnik GmbH & Co. KG P.O.Box 1260 D-84526 Tittmoning Germany www.rosenberger.de</p>	<p>Tel.: +49 8684 18-0 Fax: +49 8684 18-499 email: info@rosenberger.de</p>	<p>Page 1 / 3</p>															

TECHNICAL DATA SHEET	Rosenberger®	
FAKRA - HF PLUG FOR PCB	59S21B-40MT5-Y	
Material and plating		
Connector parts Center contact Outer contact Body Dielectric Housing	Material Brass Zinc alloy Zinc alloy PA 6T/66 PA 6T/66	Plating Gold, min. 0.8 µm, over chemical nickel Tin, 6-8 µm Tin, 6-8 µm
Electrical data		
Impedance Frequency Return loss Insertion loss Insulation resistance Center contact resistance Outer contact resistance Test voltage Working voltage Power current	50 DC to 6 GHz ≥ 26 dB, DC to 1 GHz ≤ 0.1 x √f(GHz) dB ≥ 1x10 ³ MΩ ≤ 5 mΩ ≤ 5 mΩ 750 V rms 335 V rms ≤ 1 A DC	
- Connector only, VSWR in application depends decisive on PCB layout -		
Mechanical data		
Mating cycles Engagement force Disengagement force Coding efficiency	≥ 25 ≤ 25 N ≥ 2 N ≥ 40 N	
Environmental data		
Temperature range Thermal shock Temperature and humidity Vibration and mechanical shock Dry heat Soldering profile 2002/95/EC (RoHS)	-40°C to +105°C DIN 72594-2 clause 6.2 DIN 72594-2 clause 6.3 DIN 72594-2 clause 6.1 DIN 72594-2 clause 6.4 acc. to IEC 60068-2-58 group3&4 compliant	
Tooling		
	N/A	
Packing		
Standard Weight	50 pcs in blister 4,7 g/pce	
Rosenberger Hochfrequenztechnik GmbH & Co. KG P.O.Box 1260 D-84526 Tittmoning Germany www.rosenberger.de	Tel.: +49 8684 18-0 Fax: +49 8684 18-499 email: info@rosenberger.de	Page 2 / 3

9.2. 40Pin Connector : KM17E-40DS (manufacturer : HIROSE)

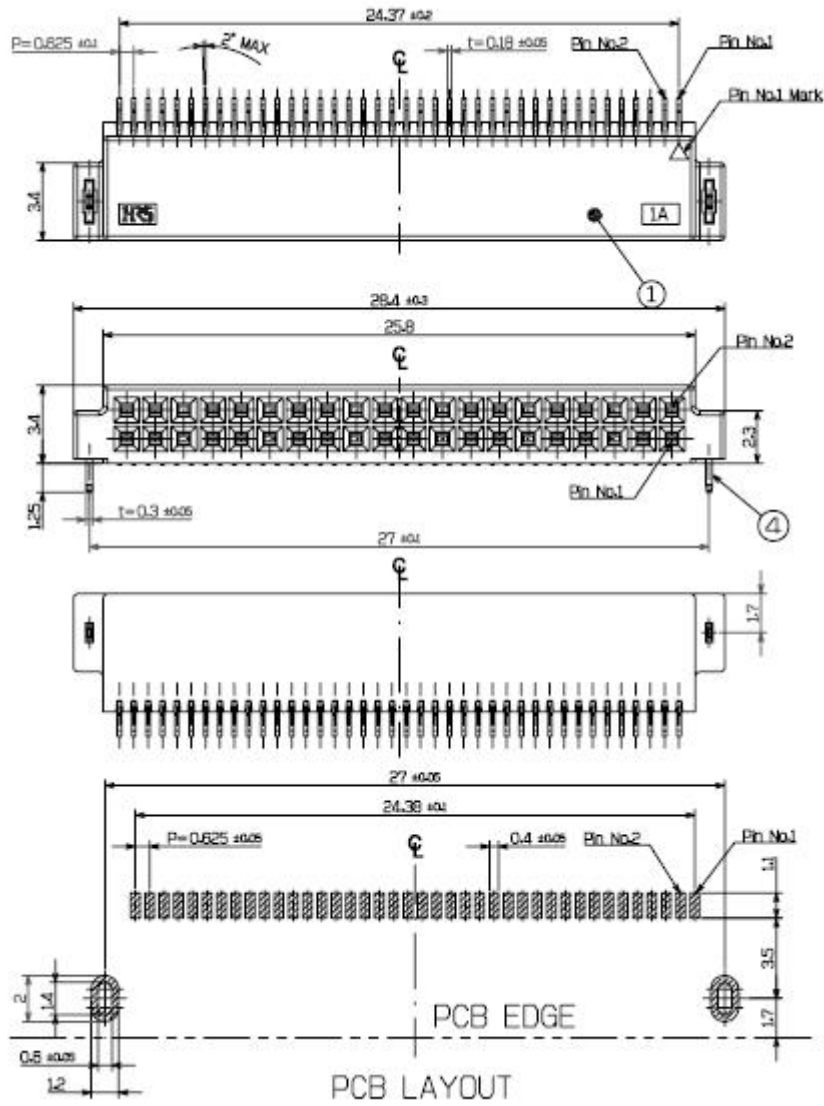


Figure 4. 40 Pin connector

10. Antenna Specification

10.1 Antenna spec.

10.1.1 Frequency Band

Frequency Band	CDMA 850	CDMA 1900
TX	824 ~ 849	1850 ~ 1910
RX	869 ~ 894	1930 ~ 1990

10.1.2 Normal value

50Ω ± Normal

10.1.3 Measuring method

The impedance over the frequency bands shall be as close as possible to 50Ω after matching. Both free space and talk position are considered.

10.2 VSWR

The impedance matching should be optimized in the more critical talk position.

10.2.1 Maximum values in free space

Band	CDMA 850		CDMA 1900	
	TX	RX	TX	RX
VSWR	2.8	2	1.2	1.8

10.2.2 Measuring Method

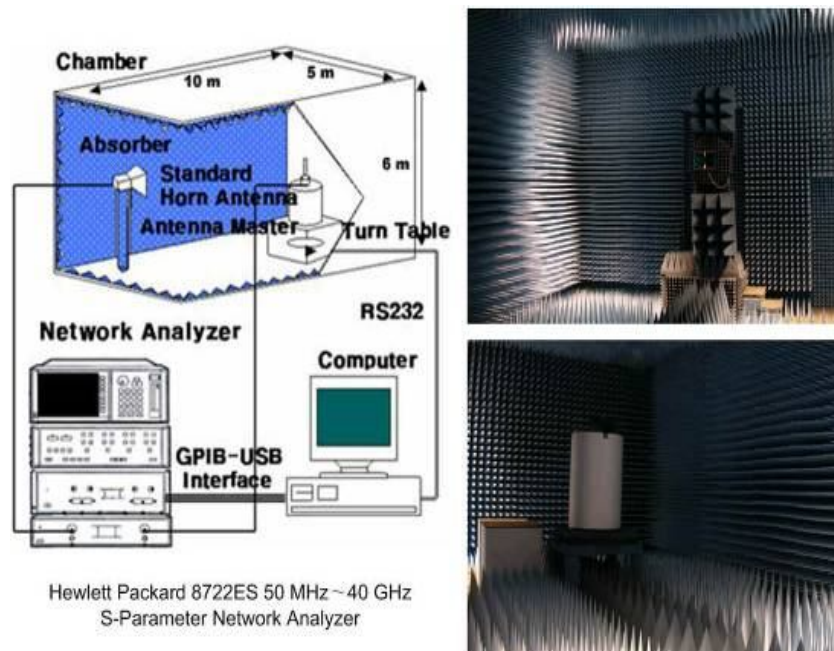
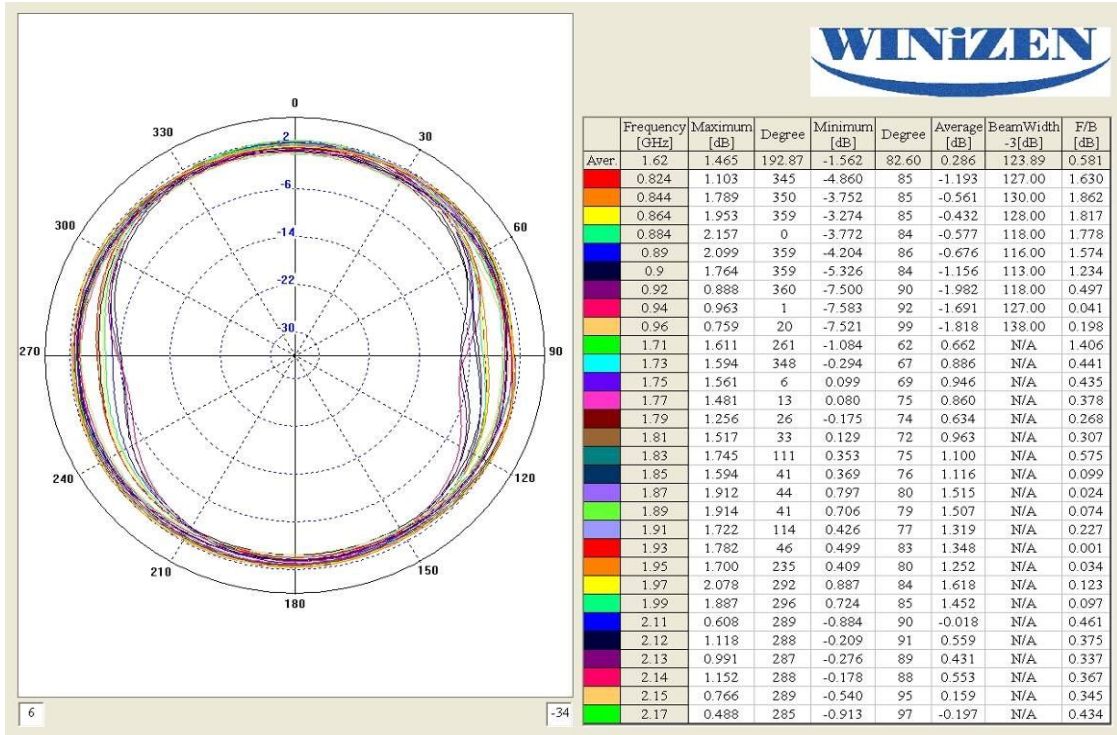


Figure 5. Chamber

a. Azimuth Pattern ; Co – pol



b. Azimuth Pattern ; Cross – pol

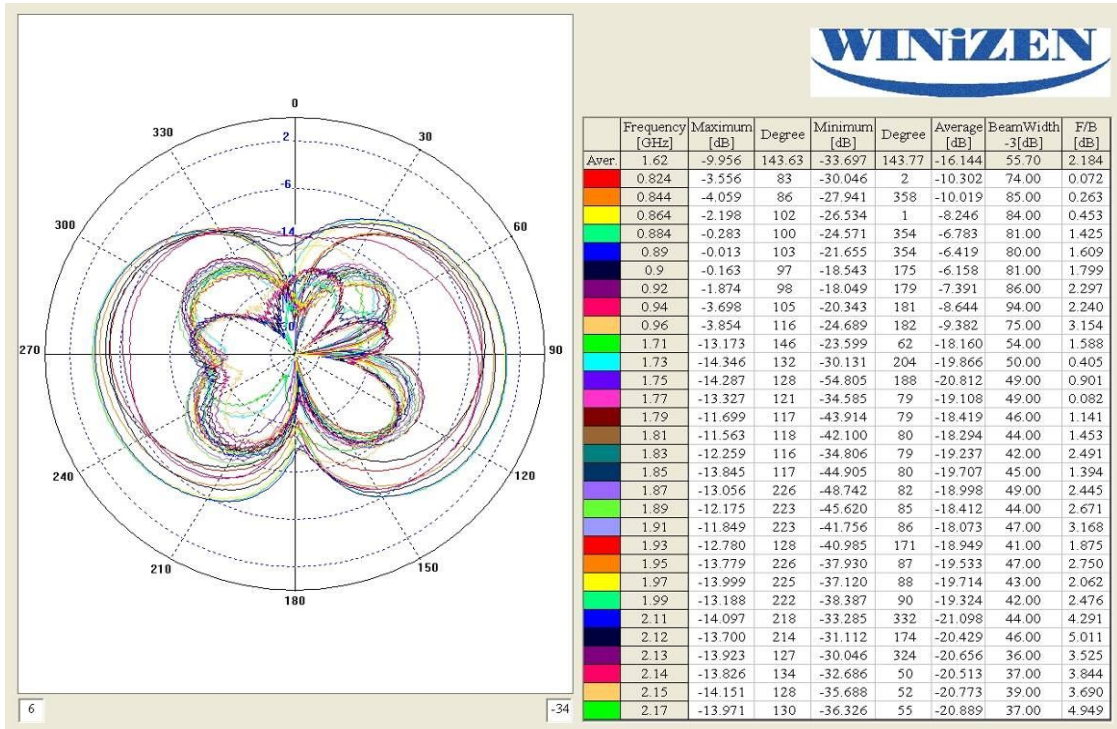


Figure 6. Gain Patterns

11. RFx information

The RF field strength of the wireless module or modules that may be embedded in your TCU is well all international RF exposure limits as known at this time. Because the wireless modules(which may be embedded into your TCU) emit less energy than is allowed in radio frequency safety standards and recommendations, manufacturer believes these modules are safe for use. Regardless of the power levels, care should be taken to minimize human contact during normal operation.

This module should be used more than 20cm(8 inches) from the body when wireless devices are on and transmitting.

This transmitter must not be collocated or operate in conjunction with any other antenna or transmitter.

Operation is subject to the following two conditions: (1) this module may not cause interference , (2) this module must accept any interference that may cause undesired operation.

11.1 Information for integrator

The integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user manual of the end product.

The user manual which is provided by integrators for end users must include the following information in a prominent location.

To comply with FCC RF exposure compliance requirements, the antenna(W8E-MWC-20 Tri-band Dipole Antenna)

used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Label for end product must include Contains FCC ID : YZP-D660V or A RF transmitter inside, FCC ID : YZP-D660V