

FCC PART 22H, PART 24E, PART 27
MEASUREMENT AND TEST REPORT

For

Shanghai Huace Navigation Technology LTD.

Building C,599 Gaojing Road, Qingpu District Shanghai

FCC ID: SY4-A01005

Report Type: Original Report	Product Type: GNSS Receiver
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Report Number: RKS160808011-00B	
Report Date: 2016-12-15	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The Shanghai Huace Navigation Technology LTD.'s product, model number: M6 (FCC ID: SY4-A01005) or the "EUT" in this report is a GNSS Receiver, which was measured approximately: 124mm (W) x 140mm (H), rated input voltage: DC 7.4V rechargeable battery.

Note: The product's series model number: M6X(X=0-9,A-Z). The difference between them was explained in the declaration letter.

**All measurement and test data in this report was gathered from production sample serial number: 20160801027.*

(Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2016-08-01.

Objective

This type approval report is prepared on behalf of Shanghai Huace Navigation Technology LTD. in accordance with Part 2, Part 22-Subpart H, Part 24-Subpart E, Part 27 of the Federal Communication Commission's rules.

The objective is to determine the compliance of EUT with FCC rules for output power, modulation characteristic, occupied bandwidth, and spurious emission at antenna terminal, spurious radiated emission, frequency stability, and band edge.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS, FCC Part 15.247 DSS, Part 15B JBP & Part 90 TNB submissions with FCC ID: SY4-A01005.

FCC Part 22H, 24E, 27 PCB submissions with FCC ID: RI7HE910.

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-Part J as well as the following parts:

Part 22 Subpart H - Public Mobile Services
Part 24 Subpart E - Personal Communication Services
Part 27 Miscellaneous wireless communications services

Applicable Standards: TIA-603-D-2010.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratories Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
Radiated emission	30MHz~1GHz	5.91dB
	1GHz~6GHz	4.68dB
	6 GHz ~18 GHz	4.92dB
	18 GHz~40 GHz	4.88dB
Occupied Bandwidth		0.5kHz
Temperature		1.0°C
Humidity		6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10-2013

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to TIA/EIA-603-D.

The final qualification test was performed with the EUT operating at normal mode.

Equipment Modifications

No modifications were made to the EUT.

Support Equipment List and Details

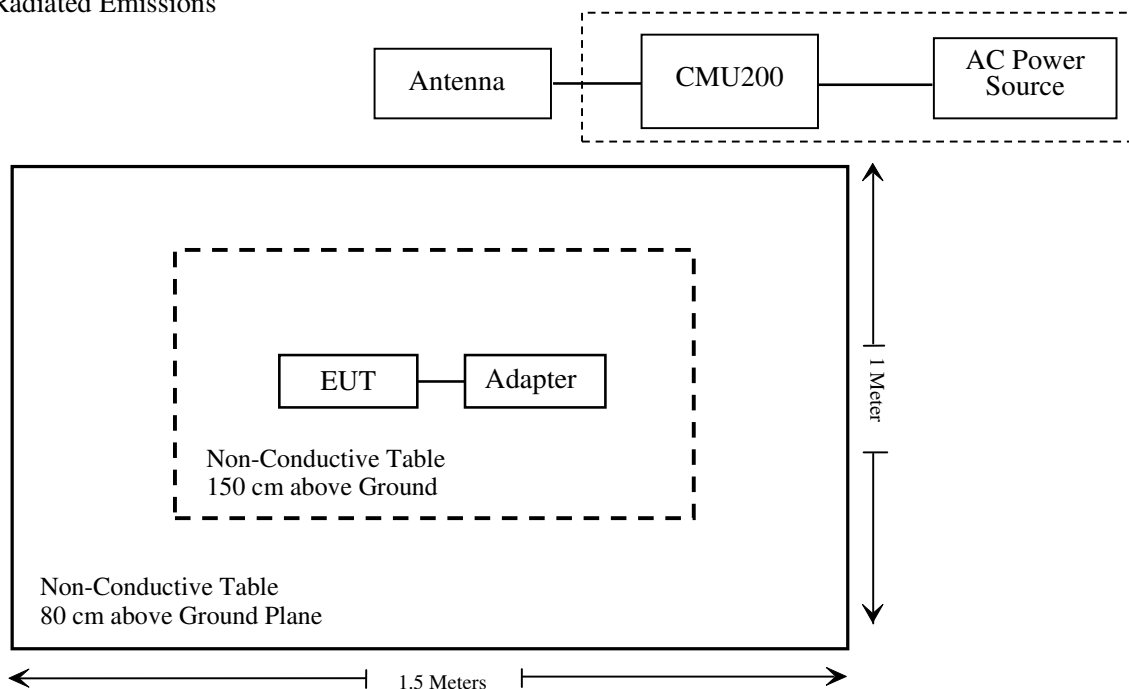
Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	109038

External I/O Cable

Cable Description	Shielding Type	Length (m)	From Port	To
/	/	/	/	/

Block Diagram of Test Setup

For Radiated Emissions



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307, §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	Compliance
§2.1046; § 22.913 (a); § 24.232 (c) ; §27.50(d)	ERP&EIRP	Compliance
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049; § 22.905; § 22.917; § 24.238; §27.53 (c)	Occupied Bandwidth	Compliance*
§ 2.1051; § 22.917 (a); § 24.238 (a) ; §27.53(c)(h)	Spurious Emissions at Antenna Terminal	Compliance*
§ 2.1053; § 22.917 (a); § 24.238 (a) ; § 27.53(c)(h)	Spurious Radiated Emissions	Compliance
§ 22.917 (a); § 24.238 (a) ; §27.53 (c) (h)	Band Edge	Compliance*
§ 2.1055; § 22.355; § 24.235 ; §27.54	Frequency stability	Compliance*

Compliance*: The EUT has the 2G/3G module. The module had been certified which the model number is HE910, FCC ID: RI7HE910. The EUT use the module series model: HE910-D. The difference between the module which is used in the EUT and the original 2G/3G module is changed the antenna, so we added the test for ERP&EIRP, Spurious Radiated Emissions and the assessment for MPE, we pre-scan the output power, the output power is similar as the power in the original report. The other data are refer to the report 1112FR12-02 which the model: HE910 (FCC ID: RI7HE910).

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-24
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-24
Sunol Sciences	Broadband Antenna	JB3	A040914-1	2016-01-09	2019-01-08
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3115	9311-4159	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Sonoma Instrunent	Amplifier	330	171377	2016-12-12	2017-12-11
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-12-12	2017-12-11
Rohde & Schwarz	Auto test Software	EMC 32	V 09.10.0	/	/
Haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-11
EAST	Regulated DC Power Supply	MCH-303D-II	14070562	/	/
RF Conducted Test					
Rohde & Schwarz	OSP120 Base Unit	OSP120	101247	2016-07-04	2017-07-03
BACL	EMC32 Version	EMC 32	V 09.10.0	/	/
Rohde & Schwarz	SMBV100A Vector Signal Generator	SMBV100A	261558	2016-07-04	2017-07-03
Rohde & Schwarz	SMB 100A Signal Generator	SMB100A	110390	2016-07-04	2017-07-03
Agilent	Power Meter	N1912A	MY5000492	2015-11-30	2016-11-29
Agilent	Power Sensor	N1921A	MY54210024	2015-11-30	2016-11-29
Rohde & Schwarz	Signal Analyzer	FSV40	101116	2016-07-04	2017-07-03
BACL	Temperature & Humidity Chamber	BTH-150	30023	2016-09-10	2017-09-09
Rohde & Schwarz	UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	110605	2016-11-25	2017-11-24
EAST	Regulated DC Power Supply	MCH-303D-II	14070562	/	/

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1307& §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)**Applicable Standard**

According to subpart § 2.1051 and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Mode	Frequency Range	Antenna Gain		Output Power		Evaluation Distance	Power Density	MPE Limit
	(MHz)	(dBi)	(numeric)	(dBm)	(mW)	(cm)	(mW/cm ²)	(mW/cm ²)
802.11b	2412-2462	0.0	1.00	16.00	39.81	20	0.0079	1.00
802.11g	2412-2462	0.0	1.00	15.00	31.62	20	0.0063	1.00
802.11n HT20	2412-2462	0.0	1.00	15.00	31.62	20	0.0063	1.00
BT	2402-2480	0.0	1.00	10.00	10.00	20	0.0020	1.00
EGPRS 850	824.2-848.8	0.0	1.00	21.00	125.89	20	0.0251	0.55
EGPRS 1900	1850.2-1909.8	0.0	1.00	21.00	125.89	20	0.0251	1.00
GPRS 850	824.2-848.8	0.0	1.00	27.00	501.19	20	0.0998	0.55
GPRS 1900	1850.2-1909.8	0.0	1.00	24.00	251.19	20	0.0500	1.00
WCDMA (Band II)	1852.4-1907.6	0.0	1.00	24.00	251.19	20	0.0500	1.00
WCDMA (Band IV)	1712.4-1752.6	0.0	1.00	24.00	251.19	20	0.0500	1.00
WCDMA (Band V)	826.4-846.6	0.0	1.00	24.00	251.19	20	0.0500	0.55
UHF	403.05-472.95	0.0	1.00	30.50	1122.02	20	0.2233	0.27

Number of Time slot	1	2	3	4
Duty Cycle	1:8.3	1:4.15	1:2.77	1:2.08
Time based Ave. power compared to slotted Ave. power	-9 dB	-6 dB	-4.26 dB	-3 dB

Note: (1) The target output power:

802.11b: 15.5±0.5dBm

802.11g: 14.5±0.5dBm,

802.11n(HT20): 14.5±0.5dBm

BT: 8.5±1.5dBm

EGPRS 850: 1 slot 27±2dBm, 2slot 25±2dBm max average power 21dBm

EGPRS 1900: 1 slot 26±2dBm, 2slot 25±2dBm max average power 21dBm

GPRS 850: 1 slot 32±2dBm, 2slot 31±2dBm max average power 27dBm

GPRS 1900: 1 slot 29±2dBm, 2slot 28±2dBm max average power 24dBm

WCDMA (Band II): 22±2 dBm

WCDMA (Band IV): 22±2 dBm

WCDMA (Band V): 22±2 dBm

UHF: Low power 21.5±0.5 dBm, High power 30±0.5 dBm

Which declared by the Manufacturer.

(2) The EUT has the BT, 2.4GHz WIFI, UHF, GSM and WCDMA functions, they can transmitting simultaneously. According to KDB 447498 D01 General RF Exposure Guidance v06 and test data, the 2.4G Wi-Fi(802.11b), GSM/WCDMA(GPRS 850), UHF (Digital) model is the worst case, their sum of MPE ratio is 0.9347, which is less than 1.0, so the collocation exposure exclusion applies.

Result: The device meet FCC MPE at 20 cm distance.

§2.1046; § 22.913 (a);§ 24.232 (c); §27.50(d)- ERP&ERIP**Applicable Standards**

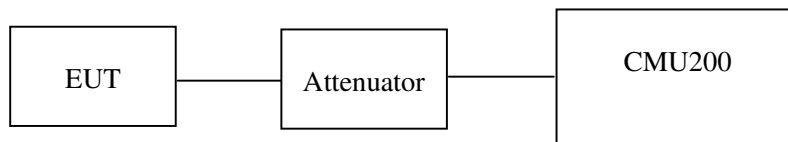
According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to FCC §2.1046 and §24.232 (c), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications..

According to §27.50(d), the maximum EIRP must not exceed 1Watts (30dBm) for 1710-1755MHzHz. The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB.

Test Procedure*Conducted method:*

The RF output of the transmitter was connected to the CMU200 through sufficient attenuation.

*Radiated method:*

TIA603-D section 2.2.17

Test Data**Environmental Conditions**

Temperature:	24 °C
Relative Humidity:	50 %
ATM Pressure:	101.0kPa

The testing was performed by Ada Yu on 2016-09-26.

Radiated Power
GPRS Mode:

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	S.G. Level (dBm)	Cable loss (dB)	Antenna Gain (dB)			
Cellular Band (Part 22H), Middle Channel										
836.6	100.55	211	1.3	H	23.47	0.26	4.86	28.07	38.45	10.38
836.6	96.62	14	1.5	V	19.52	0.26	4.86	24.12	38.45	14.33
PCS Band (Part 24E), Middle Channel										
1880.0	97.12	215	1.6	H	15.99	0.44	8.81	24.36	33	8.64
1880.0	95.06	33	1.6	V	13.86	0.44	8.81	22.23	33	10.77

EDGE Mode:

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	S.G. Level (dBm)	Cable loss (dB)	Antenna Gain (dB)			
Cellular Band (Part 22H), Middle Channel										
836.6	98.95	13	1.5	H	21.87	0.26	4.86	26.47	38.45	11.98
836.6	95.20	45	1.5	V	18.15	0.26	4.86	22.75	38.45	15.7
PCS Band (Part 24E), Middle Channel										
1880.0	97.74	17	2	H	16.64	0.44	8.81	25.01	33	7.99
1880.0	94.75	89	1.2	V	13.75	0.44	8.81	22.12	33	10.88

WCDMA Mode:

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	S.G. Level (dBm)	Cable loss (dB)	Antenna Gain (dB)			
WCDMA Band V (Part 22H), Middle Channel										
836.6	93.78	25	1.2	H	16.70	0.26	4.86	21.3	38.45	17.15
836.6	92.38	234	1.6	V	15.33	0.26	4.86	19.93	38.45	18.52
WCDMA Band IV (Part 27), Middle Channel										
1732.4	93.57	46	1.1	H	14.07	0.41	8.58	22.24	30	7.76
1732.4	89.82	159	2.3	V	10.52	0.41	8.58	18.69	30	11.31
WCDMA Band II (Part 24E), Middle Channel										
1880.0	96.91	10	1.3	H	13.31	0.44	8.81	21.68	33	11.32
1880.0	95.45	185	1.4	V	11.85	0.44	8.81	20.22	33	12.78

Note:

All above data were tested with no amplifier.

Absolute Level = SG Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

FCC § 2.1053; § 22.917 (a); § 24.238 (a) ; § 27.53(c)(h) SPURIOUS RADIATED EMISSIONS**Applicable Standards**

FCC § 2.1053, §22.917(a), § 24.238(a) and § 27.53(c) (h)

For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m) (6) of this section. In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg (\text{TX pwr in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \log_{10} (\text{power out in Watts})$

Test Data**Environmental Conditions**

Temperature:	24 °C
Relative Humidity:	48 %
ATM Pressure:	101.0kPa

The testing was performed by Ada Yu on 2016-12-14.

Test mode: Transmitting

Test mode: Transmitting (Pre-scan with Low, Middle, High channel, and the worse case data as below)

30 MHz ~ 10 GHz:

Cellular Band (Part 22H)

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)			
GSM Mode, Middle channel										
320.55	51.27	269	1.8	H	-61.95	0.20	4.01	-58.14	-13	45.14
320.55	45.53	326	2	V	-64.55	0.20	4.01	-60.74	-13	47.74
1673.20	48.35	203	1.6	H	-62.58	0.39	8.48	-56.88	-13	43.88
1673.20	48.24	255	1.5	V	-62.69	0.39	8.48	-56.99	-13	43.99
2509.80	49.65	143	2.0	H	-61.74	0.49	10.09	-55.58	-13	42.58
2509.80	49.85	44	1.7	V	-61.54	0.49	10.09	-55.38	-13	42.38
WCDMA Mode, Middle channel										
320.55	50.73	35	1.8	H	-61.95	0.20	4.01	-58.14	-13	45.14
320.55	46.31	161	2	V	-64.55	0.20	4.01	-60.74	-13	47.74
1673.20	47.24	293	1.6	H	-63.69	0.39	8.48	-57.99	-13	44.99
1673.20	47.25	86	2.0	V	-63.68	0.39	8.48	-57.98	-13	44.98
2509.80	43.85	18	1.6	H	-57.54	0.49	10.09	-51.38	-13	38.38
2509.80	43.74	127	1.9	V	-57.65	0.49	10.09	-51.49	-13	38.49

30 MHz ~ 20 GHz:**PCS Band (Part 24E)**

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)			
GSM Mode, Middle channel										
278.55	50.68	328	1.3	H	-59.56	0.18	3.81	-55.93	-13	42.93
278.55	49.79	360	1.8	V	-62.75	0.18	3.81	-59.12	-13	46.12
3760.00	52.44	177	1.8	H	-52.89	0.59	9.74	-43.74	-13	30.74
3760.00	56.46	279	1.5	V	-49.99	0.59	9.74	-40.84	-13	27.84
5640.00	51.88	330	1.6	H	-49.77	0.67	10.47	-39.97	-13	26.97
5640.00	52.56	161	1.4	V	-50.96	0.67	10.47	-41.16	-13	28.16
WCDMA Mode, Middle channel										
278.55	50.78	32	1.6	H	-59.46	0.18	3.81	-55.83	-13	42.83
278.55	50.34	176	1.3	V	-61.76	0.18	3.81	-58.13	-13	45.13
3760.00	52.85	300	1.7	H	-52.48	0.59	9.74	-43.33	-13	30.33
3760.00	53.87	105	1.5	V	-52.58	0.59	9.74	-43.43	-13	30.43
5640.00	52.89	190	1.4	H	-38.76	0.67	10.47	-38.96	-13	25.96
5640.00	55.85	291	1.5	V	-37.67	0.67	10.47	-37.87	-13	24.87

WCDMA Band IV (Part 27)

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable Loss (dB)	Antenna Gain (dB)			
WCDMA Mode, Middle channel										
301.25	48.68	135	1.5	H	-61.98	0.20	3.86	-58.32	-13	45.32
301.25	53.23	198	1.9	V	-59.33	0.20	3.86	-55.67	-13	42.67
3464.80	52.73	302	1.7	H	-53.70	0.54	9.88	-44.36	-13	31.36
3464.80	57.04	145	2.1	V	-51.49	0.54	9.88	-42.15	-13	29.15
5197.20	54.50	175	2.4	H	-49.13	0.65	10.3	-39.48	-13	26.48
5197.20	55.45	243	1.3	V	-48.18	0.65	10.3	-38.53	-13	25.53

Note:

1) Absolute Level = SG Level - Cable loss + Antenna Gain

2) Margin = Limit- Absolute Level

******* END OF REPORT *******