TESTREPORT

Applicant Name :	Franklin Technology Inc.
Address :	906 JEI Platz, 186, Gasan digital 1-ro, Gumcheon-Gu Seoul, South Korea 08502
Report Number:	RA230104-00558E-RF-00E
FCC ID:	XHG-CG890

Test Standard (s)

FCC PART 96

Sample Description

Product Type:	Home Router CG890
Model No.:	CG890
Multiple Model(s) No.:	N/A
Trade Mark:	N/A
Date Received:	2023/01/04
Report Date:	2023/02/27

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Andy Yu
EMC Engineer

Approved By:

Candy Li
EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".
Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA230104-00558E-RF-00E	Original Report	2023-02-27

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Frequency Range	LTE Band 48: 3550-3700MHz(TX/RX)
Modulation Technique	4G: QPSK, 16QAM
Carrier Aggregation	None Carrier aggregation
Antenna Specification*	ANT4: LTE Band 48: -0.6dBi (provided by the applicant)
Voltage Range	DC 12V from adapter or DC 3.8V from battery
Sample serial number	1XJ7-2 for Radiated Emissions Test 1XJH-12 for RF Conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition
Adapter information	Model: APS-M024120200W-G Input: AC 100-240V, 50/60Hz, 0.6A Max Output: DC 12V, 2.0A

Objective

This test report is in accordance with Part 2-Subpart J and Part 96 of the Federal Communication Commission's rules.

The objective is to determine the compliance of the 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.

Test Methodology

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

Part 96 –Citizens Broadband Radio Service

ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		$0.082*10^{-7}$
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	9kHz - 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz -26.5GHz	5.06dB
	26.5GHz -40GHz	4.72dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358,the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

Frequency band	Bandwidth (MHz)	Test Frequency(MHz)		
		Low	Middle	High
LTE B48	5	3552.5	3625.0	3697.5
	10	3555	3625.0	3695
	15	3557.5	3625	3692.5
	20	3560	3625	3690

Equipment Modifications

No modification was made to the EUT.

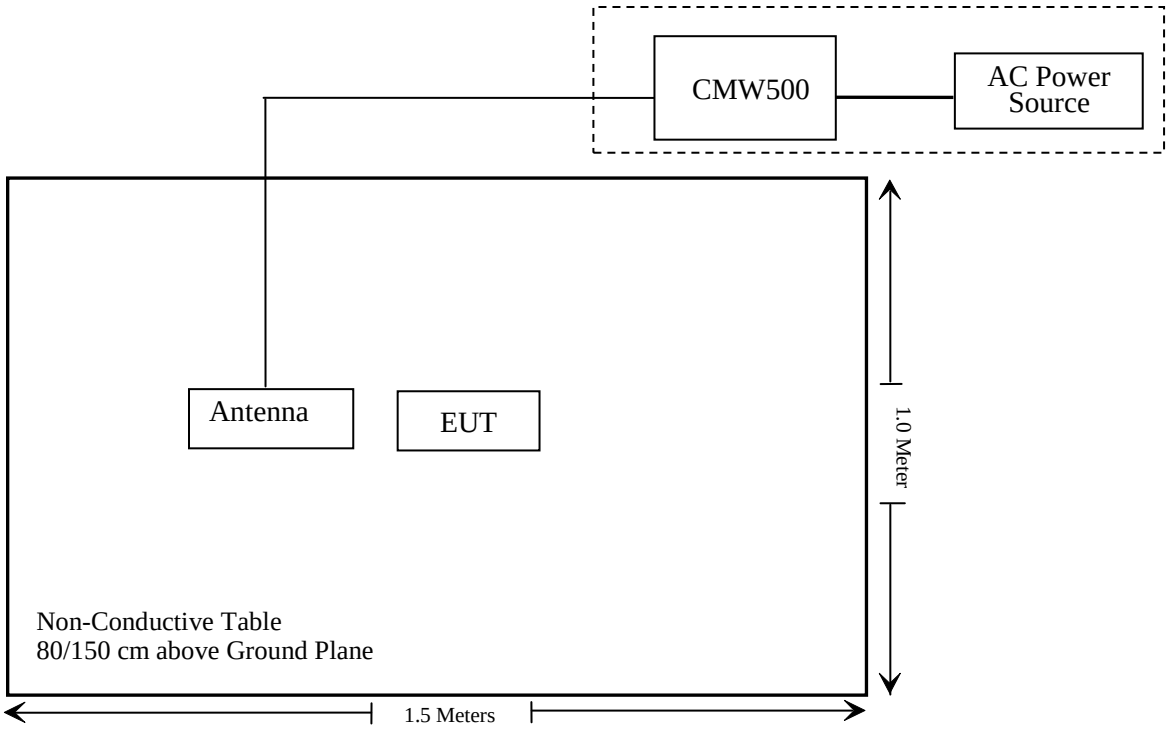
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	154606

Support Cable Description

Cable Description	Length (m)	From / Port	To
Unshielded Un-detachable AC cable	1.2	AC Power	CMW50

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result	Remark
FCC §1.1307 (b) (3) & §2.1091	MPE-Based Exemption	Compliant	-
§2.1046; §96.41 (b) (g)	RF Output Power	Reporting only	-
§ 2.1047	Modulation Characteristics	Not Applicable	/
§ 2.1049; §96.41	Occupied Bandwidth	-	See Note
§ 2.1051; §96.41	Spurious Emissions at Antenna Terminal	-	See Note
§ 2.1053; §96.41	Field Strength of Spurious Radiation	Compliant	-
§2.1049, §96.41(e)	Out-Of-Band Emissions and Band Edge	-	See Note
§ 2.1055; §96.41	Frequency stability	-	See Note

Note:
1. According to manufacturer declared, the WWAN module installed in EUT has the following changes based on the certified module (FCC ID: XHG-M2500), which granted on 08/30/2022:

(1) Adding the Frequency band of LTE Band 7 by software upgrade
(2) Adding EN-DC mode: DC_12A_n66A/ DC_5A_n48A/ DC_5A_n66A by software upgrade

Based on the above differences, it will affect all test data for the new adding frequency bands; all the test items for those bands were performed.

2. The RF output power was spot checked and it's consistently with the module report.
3. The test data for other bands refer to the module report.
4. The ATC is responsible for all the information provided in this report, except when information is provided by the customer as identified in this report.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2022/11/25	2023/11/24
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2022/11/25	2023/11/24
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07
Quinstar	Amplifier	QLW-184055 36-J0	15964001002	2022/11/08	2023/11/07
Unknown	RF Coaxial Cable	No.10	N050	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.11	N1000	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.12	N040	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.13	N300	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.14	N800	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.15	N600	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.16	N650	2022/11/25	2023/11/24
Schwarzbeck	Bilog Antenna	VULB9163	9163-194	2021/07/06	2024/07/05
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-655	2022/12/26	2025/12/25
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2022/11/30	2025/11/29
PASTERNACK	Horn Antenna	PE9852/2F-20	1120 (ATC-BA-024-1)	2023/01/04	2026/01/03
PASTERNACK	Horn Antenna	PE9852/2F-20	1120 (ATC-BA-025-1)	2023/01/04	2026/01/03
PASTERNACK	Horn Antenna	PE9850/2F-20	720 (ATC-BA-024)	2023/01/04	2026/01/03
PASTERNACK	Horn Antenna	PE9850/2F-20	720 (ATC-BA-025)	2023/01/04	2026/01/03
Unknown	RF Coaxial Cable	No.16	N200	2022/11/25	2023/11/24
Agilent	Signal Generator	N5183A	MY51040755	2022/11/25	2023/11/24
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2022/11/25	2023/11/24

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	154606	2022/11/25	2023/11/24
WEINSCHEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	Each time

* Statement of Traceability: Shenzhen Accurate Technology Co., Ltd. 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 (b) (3) & §2.1091- MPE-Based Exemption

Applicable Standard

According to subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

According to KDB 447498 D04 Interim General RF Exposure Guidance

MPE-Based Exemption:

General frequency and separation-distance dependent MPE-based effective radiated power(ERP) thresholds are in Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] to support an exemptionfrom further evaluation from 300 kHz through 100 GHz.

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.

Ris the minimum separation distance in meters
f = frequency in MHz

For multiple RF sources: Multiple RF sources are exempt if:

in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation:

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Result

For worst case:

Mode	Frequency (MHz)	Tune up conducted power	Antenna Gain		ERP		Evaluation Distance (m)	ERP Limit (W)
		(dBm)	(dBi)	(dBd)	(dBm)	(W)		
2.4G Wi-Fi	2412-2462	21.5	3.1	0.95	22.45	0.176	0.3	1.728
5G Wi-Fi	5150-5250	20.5	2.2	0.05	20.55	0.114	0.3	1.728
	5725-5850	20.5	2.2	0.05	20.55	0.114	0.3	1.728
WCDMA B2	1850-1910	24.0	3.5	1.35	25.35	0.343	0.3	1.728
WCDMA B4	1710-1755	24.0	3.5	1.35	25.35	0.343	0.3	1.728
WCDMA B5	824-849	25.0	2.0	-0.15	24.85	0.305	0.3	0.949
LTE B2	1850-1910	23.0	3.5	1.35	24.35	0.272	0.3	1.728
LTE B4	1710-1755	23.5	3.5	1.35	24.85	0.305	0.3	1.728
LTE B5	824-849	23.5	2.0	-0.15	23.35	0.216	0.3	0.949
LTE B7	2500-2570	24.0	0.3	-1.85	22.15	0.164	0.3	1.728
LTE B12	699-716	24.0	2.1	-0.05	23.95	0.248	0.3	0.805
LTE B41	2496-2690	27.0	0.3	-1.85	25.15	0.327	0.3	1.728
LTE B48	3550-3700	23.0	-0.6	-2.75	20.25	0.106	0.3	1.728
LTE B66	1710-1780	23.5	3.5	1.35	24.85	0.305	0.3	1.728
LTE B71	663-698	24.0	1.8	-0.35	23.65	0.232	0.3	0.764
5G n48	3550-3700	23.5	-0.6	-2.75	20.75	0.119	0.3	1.728
5G n66	1710-1780	24.0	3.6	1.45	25.45	0.351	0.3	1.728
5G n71	663-698	24.5	1.8	-0.35	24.15	0.260	0.3	0.764

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
2. The 2.4G Wi-Fi can transmit at the same time with the 5G Wi-Fi.
3. 0dBd=2.15dBi

Simultaneous transmitting consideration (worst case):

The ratio= $ERP_{2.4G\ Wi\text{-}Fi}/ ERP_{Limit} + ERP_{5G\ Wi\text{-}Fi}/ ERP_{Limit} + ERP_{WCDMA}/ERP_{Limit} + ERP_{5G\ NR}/ ERP_{Limit}$
$=0.176/1.728+0.114/1.728+0.305/0.949+0.260/0.764=0.830<1.0$

So simultaneous exposure is compliant.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 30cm from nearby persons.

Result: Compliant.

FCC §2.1047 - MODULATION CHARACTERISTIC

According to FCC §2.1047(d), Part 96, there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

FCC §2.1046& §96.41(b) (g) - RF OUTPUT POWER

Applicable Standard

According to §96.41

(b)Power limits:Unless otherwise specified in this section, the maximum effective isotropic radiated power (EIRP) and maximum Power Spectral Density (PSD) of any CBSD and End User Device must comply with the limits shown in the table in this paragraph (b):

Device must comply with the limits shown in the table in this paragraph (b):

Device	Maximum EIRP (dBm/10 megahertz)	Maximum PSD (dBm/MHz)
End User Device	23	n/a
Category A CBSD	30	20
Category B CBSD[1]	47	37

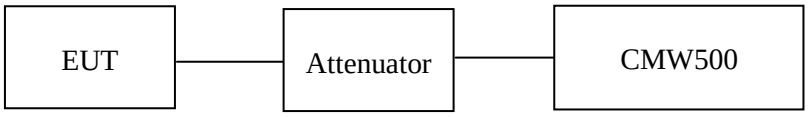
1Category B CBSDs will only be authorized for use after an ESC is approved and commercially deployed consistent with §§96.15 and 96.67.

(g)Power measurement:The peak-to-average power ratio (PAPR) of any CBSD transmitter output power must not exceed 13 dB. PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities or another Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

Test Procedure

Conducted method:

The RF output of the transmitter was connected to the CMW500 through sufficient attenuation.



Note: the path loss (cable loss and attenuator) was included to the test result.

Test Data

Environmental Conditions

Temperature:	25℃
Relative Humidity:	56%
ATM Pressure:	101.0 kPa

The testing was performed by Clenn Jiang on 2023-02-05.

LTE Band 48:

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
5.0	QP SK	RB1#0	21.23	21.10	21.22	20.63	20.50	20.62
		RB1#13	21.34	21.08	21.00	20.74	20.48	20.40
		RB1#24	21.09	21.04	21.11	20.49	20.44	20.51
		RB15#0	20.05	20.04	20.19	19.45	19.44	19.59
		RB15#10	20.04	19.91	19.86	19.44	19.31	19.26
		RB25#0	20.02	19.89	19.99	19.42	19.29	19.39
	16QAM	RB1#0	20.19	20.33	20.43	19.59	19.73	19.83
		RB1#13	20.58	20.48	20.10	19.98	19.88	19.50
		RB1#24	20.42	20.37	19.96	19.82	19.77	19.36
		RB15#0	18.96	18.88	19.04	18.36	18.28	18.44
		RB15#10	19.07	19.03	19.10	18.47	18.43	18.50
		RB25#0	19.03	18.89	19.10	18.43	18.29	18.50
10.0	QPSK	RB1#0	21.23	21.36	21.32	20.63	20.76	20.72
		RB1#25	21.14	21.32	21.32	20.54	20.72	20.72
		RB1#49	21.27	21.23	21.09	20.67	20.63	20.49
		RB25#0	20.19	20.07	20.01	19.59	19.47	19.41
		RB25#25	20.12	19.88	19.98	19.52	19.28	19.38
		RB50#0	20.21	20.15	19.97	19.61	19.55	19.37
	16QAM	RB1#0	20.55	20.29	20.32	19.95	19.69	19.72
		RB1#25	20.38	20.39	20.55	19.78	19.79	19.95
		RB1#49	20.31	20.51	20.30	19.71	19.91	19.70
		RB25#0	19.01	19.15	19.31	18.41	18.55	18.71
		RB25#25	19.20	19.21	19.00	18.60	18.61	18.40
		RB50#0	19.09	19.07	19.11	18.49	18.47	18.51

Bandwidth (MHz)	Modulation	RB size/ RB Offset	Conducted Average Output Power (dBm)			EIRP(dBm)		
			Low	Mid	High	Low	Mid	High
15.0	QPSK	RB1#0	21.18	21.11	21.17	20.58	20.51	20.57
		RB1#38	21.40	21.13	20.85	20.80	20.53	20.25
		RB1#74	20.99	20.94	20.98	20.39	20.34	20.38
		RB36#0	20.01	19.88	20.01	19.41	19.28	19.41
		RB36#39	20.17	20.04	19.60	19.57	19.44	19.00
		RB75#0	19.82	19.84	20.10	19.22	19.24	19.50
	16QAM	RB1#0	19.96	20.24	20.35	19.36	19.64	19.75
		RB1#38	20.66	20.36	20.11	20.06	19.76	19.51
		RB1#74	20.29	20.45	20.06	19.69	19.85	19.46
		RB36#0	19.00	18.86	18.88	18.40	18.26	18.28
		RB36#39	19.23	18.98	19.25	18.63	18.38	18.65
		RB75#0	18.99	18.95	18.97	18.39	18.35	18.37
20.0	QPSK	RB1#0	21.18	21.41	21.37	20.58	20.81	20.77
		RB1#50	21.27	21.16	21.42	20.67	20.56	**20.82**
		RB1#99	21.09	21.18	21.17	20.49	20.58	20.57
		RB50#0	20.18	20.03	20.08	19.58	19.43	19.48
		RB50#50	19.94	20.02	20.20	19.34	19.42	19.60
		RB100#0	20.25	20.27	19.91	19.65	19.67	19.31
	16QAM	RB1#0	20.63	20.22	20.13	20.03	19.62	19.53
		RB1#50	20.62	20.45	20.43	20.02	19.85	19.83
		RB1#99	20.20	20.67	20.31	19.60	**20.07**	19.71
		RB50#0	19.02	19.04	19.34	18.42	18.44	18.74
		RB50#50	19.02	19.20	18.91	18.42	18.60	18.31
		RB100#0	19.00	18.90	19.04	18.40	18.30	18.44

Note: EIRP(dBm) = Conducted Power(dBm) + Antenna Gain(dBi)
For Band48: Antenna Gain = -0.6dBi
Limit: EIRP≤23dBm/10MHz

For 5MHz mode, the reference bandwidth(10MHz) is greater than the channel bandwidth(5MHz), so the channel power is equal to the test result in dBm/10MHz
For 10MHz mode, the channel power is equal to the test result in dBm/10MHz
For 15MHz/20MHz mode, the channel power is sum of 15MHz/20MHz bandwidth, the result is less than 23dBm, so in any 10MHz bandwidth, it will not exceed the limit

FCC §2.1053& §96.41(e) (2) (3) - SPURIOUS RADIATED EMISSIONS

Applicable Standard

FCC §2.1053and §96.41(e) (2) (3).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1051.

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 receiving 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.

Test Data

Environmental Conditions

Temperature:	24.5~25℃
Relative Humidity:	50~56%
ATM Pressure:	101.0kPa

The testing was performed by Jimi Zheng on 2023-02-03 for below 1GHz and from2023-01-10 to2023-01-11 for above 1GHz.

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EUT operation mode: Transmitting (Scan with X-AXIS, Y-AXIS, Z-AXIS, the worst case Y-AXIS was recorded)

The worst case is as below:

LTE Bands: (pre-scan all bandwidth/modulation, the worst case as below)

Frequency (MHz)	Receiver Reading (dBm)	Turntable Degree	Rx Antenna		Substituted Factor (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)				
LTE Band 48, Test frequency range: 30MHz-38GHz								
QPSK,5MHz,3552.5MHz								
960.65	-61.49	123	1.8	H	10	-51.49	-40	-11.49
960.65	-61.37	142	1.2	V	11.7	-49.67	-40	-9.67
7105.0	-63.60	353	1.3	H	16.8	-46.80	-40	-6.80
7105.0	-61.80	246	1.8	V	16.7	-45.10	-40	-5.10
QPSK, 5MHz,3625MHz								
960.38	-60.64	278	2.2	H	10	-50.64	-40	-10.64
960.38	-61.08	209	2.3	V	11.7	-49.38	-40	-9.38
7250.0	-64.30	203	2.4	H	18.9	-45.40	-40	-5.40
7250.0	-64.30	114	1.8	V	18.5	-45.80	-40	-5.80
QPSK, 5MHz,3697.5MHz								
959.19	-61.04	238	1.2	H	10	-51.04	-40	-11.04
959.19	-61.69	194	2.3	V	11.7	-49.99	-40	-9.99
7395	-64.00	277	1.5	H	19.8	-44.20	-40	-4.20
7395	-64.30	206	1.0	V	19.0	-45.30	-40	-5.30

Note:
Absolute Level = Reading Level + Substituted Factor
Substituted Factor contains: Substituted Level - Cable loss+ Antenna Gain
Margin = Limit - Absolute Level

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