Application Note

Anritsu

# LTE Measurement

## MT8820C
Radio Communication Analyzer

# Revision History

| Ver. No | Date | Contents | Related product software version |
|---|---|---|---|
| 1.00 | 2010/June | First edition | MX882012C Ver. 20.10<br>MX882042C Ver. 20.10 |
| 2.00 | 2010/August | 1.1.2 MX882012C-006, 1.1.3 MX882012C-011,<br>1.5 IP Data Transfer Test | MX882012C Ver. 20.10<br>MX882042C Ver. 20.10 |
| 3.00 | 2010/October | Added following measurement procedures:<br>1.3.26. 6.2.4 Additional Maximum Power Reduction (A-MPR)<br>6.6.2.2 Additional Spectrum Emission Mask<br>1.3.29 7.9 Spurious Emissions<br>Supports following standard changes:<br>1.3.13. 6.3.5.2 Power Control Relative Power Tolerance<br>Revised No. and Test Parameter name in chart 1.3-1 6.3.5.2<br>Revised No. and Remote Command in chart 1.3-2 6.3.5.2<br>Added comment<br>1.3,1.3.1, 1.3.2, 1.3.3, 1.3.5,<br>Changed comment to "Shows measurement example for 20 measurements".<br>1.3.6, 1.3.7, 1.3.8, 1.3.9, 1.3.10, 1,3,15, 1.3.16, 1.3.17, 1.3.19, 1.3.20, 1.3.21, 1.3.22, 1.3.23, 1.3.24, 1.3.25,<br>Error Correction<br>Contents | MX882012C Ver. 20.10<br>MX882042C Ver. 20.10 |
| 4.00 | 2011/March | Following items changed in all documentation<br>- Description for RX - Reference Sens./Freq. Error changed to RX - Ref. Sens./Freq. Error<br>- Described support for MX882013C and MX882043C<br><br>1.2 Supports 3GPP measurement standards (3GPP TS 36.521-1 V9.2.0) (added 6.5.2.1A PUSCH-EVM with exclusion period).<br><br>Updated below:<br>1.3.5. Broadcast Information Update<br><br>Changed measurement result examples for following items:<br>1.3.10. 6.3.4.1 General ON/OFF time mask<br>1.3.12. 6.3.5.1 Power Control Absolute power tolerance<br>1.3.13. 6.3.5.2 Power Control Relative power tolerance (changed from TX3 - Relative Power (Sub-test A) to TX3 - Relative Power (Ramping Up A))<br>1.3.21. 6.5.2.3 In-band emissions for non-allocated RB – PUSCH (Changed red box for Carrier Leakage and General, IQ Image and Carrier Leakage for In-Band Emissions from Avg. to Max.)<br>1.3.22. 6.5.2.3 In-band emissions for non-allocated RB – PUCCH (Changed red box of General, IQ Image and Carrier Leakage for In-Band Emissions from Avg. to Max.)<br>1.3.23. 6.5.2.4 EVM equalizer spectrum flatness<br>1.3.28. 7.3 Reference sensitivity level<br>1.3.29. 7.4 Maximum input level<br><br>Changed measurement procedure for following items:<br>1.3.10. 6.3.4.1 General ON/OFF time mask<br>1.3.11. 6.3.4.2 PRACH and SRS time mask: Changed to “connected”<br>1.3.17. 6.5.2.1 Error Vector Magnitude (EVM) - PUCCH<br>1.3.18. 6.5.2.1 Error Vector Magnitude (EVM) – PRACH: Changed to “connected”<br>1.3.23. 6.5.2.4 EVM equalizer spectrum flatness<br><br>1.3.19. Added 6.5.2.1A PUSCH-EVM with exclusion period<br>1.3.31. Added 6.5.2.1A PUSCH-EVM with exclusion period descriptions to 3GPP test item and supported test parameter | MX882012C/13C/42C/43C<br>Ver22.10 |

| | | | |
|---|---|---|---|
| | | 1.3.32. Changed Remote Command in 1.3-2 Remote Commands list Limiting Pass/Fail Judgement as follows:<br>- Added 6.5.2.1A PUSCH-EVM with exclusion period description<br>- Added Remote Command TP_PCTREL_RMP_E description to 6.3.5.2 Power Control Relative power tolerance<br>- Described remote command change for 6.5.2.4 EVM equalizer spectrum flatness<br><br>Changed following Parameter setting display<br>1.5.4. Position Registration and Packet Connection (single antenna)<br>1.5.7. Position Registration and Packet Connection (2X2 MIMO) | |
| | | | |

# Contents

# 1. LTE Measurement Software

## 1.1. Specifications

### 1.1.1. MX882012C/ MX882013C (Call Processing)

**Chart1.1-1: LTE Measurement Software Specifications (MX882012C/ MX882013C) (1/2)**

| Measurement Item | Specifications | |
|---|---|---|
| Electrical | Typical values (typ.) are only for reference and are not guaranteed. | |
| Modulation Analysis | Frequency: | 400 to 2700 MHz |
| | Input level: | –40 to +35 dBm (Main 1) |
| | Carrier frequency accuracy: | ±(Setting frequency x Reference oscillator accuracy + 15 Hz) |
| | Modulation accuracy | |
| | Residual vector error: | ≤2.5% (measurement count = 20) |
| | In-band emissions: | ≤–40 dB<br>(≥–10 dBm, allocated RB ≤18) |
| | Measurement object: | PUSCH, PRACH, PUCCH |
| RF Power | Frequency: | 400 to 2700 MHz |
| | Input level: | –60 to +35 dBm (Main 1) |
| | Measurement accuracy: | ±0.5 dB (–20 ≤ p ≤ +35 dBm)<br>typ. ±0.3 dB (–20 to +35 dBm)<br>±0.7 dB (–50 ≤ p < –20 dBm)<br>±0.9 dB (–60 ≤ p < –50 dBm)<br>After calibration, at 10° to 40°C<br>(p: Input Level) |
| | Linearity: | ±0.2 dB (–40 to 0 dB, ≥–50 dBm)<br>±0.4 dB (–40 to 0 dB, ≥–60 dBm) |
| | Relative measurement error: | < 2 dB<br>typ. ±0.10 dB (–40 to 0 dB, ≥–50 dBm) |
| | Measurement object: | PUSCH, PRACH, PUCCH |
| Occupied Bandwidth | Frequency: | 400 to 2700 MHz |
| | Input level: | –10 to +35 dBm (Main 1) |
| Adjacent Channel Leakage Power | Frequency: | 400 to 2700 MHz |
| | Input level: | –10 to +35 dBm (Main 1) |
| | Measurement point: | E-UTRA ACLR1<br>UTRA ACLR1<br>UTRA ACLR2 |
| | Measurement range: | ≥45 dB (E-UTRA ACLR1)<br>≥50 dB (UTRA ACLR1)<br>≥55 dB (UTRA ACLR2) |
| Spectrum Emission Mask | Frequency: | 400 to 2700 MHz |
| | Input level: | –10 to +35 dBm (Main 1) |

**Chart1.1-1: LTE Measurement Software Standard (MX882012C/ MX882013C) (2/2)**

| Measurement Item | Specifications |
|---|---|
| RF Signal Generator | Output frequency: 400 to 2700 MHz (1 Hz step)<br>AWGN level: Off, –20 to +5 dB (0.1 dB step, Relative level between Ior (Total power) and AWGN)<br>AWGN level accuracy: ±0.2 dB (level accuracy relative to Ior AWGN) |
| Throughput Measurements | Function: Throughput measurements using RMC<br>Measurement item: ACK and NACK reported from mobile terminal |
| Call Processing | Call control: Location registration, call processing using RMC<br>(Executes each processing in 3GPP standards and performs Pass/Fail evaluation)<br>Mobile terminal control: Output level<br>(Executes each UE control in 3GPP standards) |

1.1.2. MX882012C-006/ MX882013C-006

**Chart1.1-1: LTE FDD IP Data Transfer**

| Item | Specifications |
|---|---|
| Function | The Ethernet port of the LTE measurement hardware can be used to transfer data to external devices. |

1.1.3. MX882012C-011/ MX882013C-011

**Chart1.1-1: LTE FDD 2x2 MIMO DL**

| Item | Specifications |
|---|---|
| Function | This can be used to measure the Rx performance of 2x2 MIMO mobile wireless terminals. |
| RF Signal Generator | Output frequency: 400 to 2700 MHz (1 Hz per step) |
| Throughput measurement | Function: Throughput measurement using RMC<br>Measurement target: ACK and NACK reported from UE |

### 1.1.4. MX882042C/ MX882043C (Non-Call Processing)

**Chart1.1-2: Measurement Software Specifications (MX882042C)**

| Measurement Item | Specifications |
|---|---|
| Electrical | Typical values (typ.) are only for reference and are not guaranteed. |
| Modulation Analysis | Frequency: 400 to 2700 MHz<br>Input level: –40 to +35 dBm (Main 1)<br>Carrier frequency accuracy: ±(Setting frequency x Reference oscillator accuracy + 15 Hz)<br>Modulation accuracy<br>Residual vector error: ≤2.5% (measurement count = 20)<br>In-band emissions: ≤–40 dB (≥–10 dBm, Allocated RB ≤18)<br>Measurement object: PUSCH |
| RF Power | Frequency: 400 to 2700 MHz<br>Input level: –60 to +35 dBm (Main 1)<br>Measurement accuracy: ±0.5 dB (–20 ≤ p ≤ +35 dBm)<br>typ. ±0.3 dB (–20 to +35 dBm)<br>±0.7 dB (–50 ≤ p < –20 dBm)<br>±0.9 dB (–60 ≤ p < –50 dBm)<br>After calibration, at 10° to 40°C<br>(p: Input Level)<br>Linearity: ±0.2 dB (–40 to 0 dB, ≥–50 dBm)<br>±0.4 dB (–40 to 0 dB, ≥–60 dBm)<br>Relative measurement error Range below 2 dB<br>typ. ±0.10 dB (–40 to 0 dB, ≥–50 dBm)<br>Measurement object: PUSCH |
| Occupied Bandwidth | Frequency: 400 to 2700 MHz<br>Input level: –10 to +35 dBm (Main1) |
| Adjacent Channel Leakage Power | Frequency: 400 to 2700 MHz<br>Input level: –10 to +35 dBm (Main1)<br>Measurement point: E-UTRA ACLR1<br>UTRA ACLR1<br>UTRA ACLR2<br>Measurement range: ≥45 dB (E-UTRA ACLR1)<br>≥50 dB (UTRA ACLR1)<br>≥55 dB (UTRA ACLR2) |
| Spectrum Emission Mask | Frequency: 400 to 2700 MHz<br>Input level: –10 to +35 dBm (Main1) |

## 1.2. 3GPP Measurement Specification (3GPP TS 36.521-1 V9.2.0) Table

| | Item | Comment | Non-Call Processing*1 | Call Processing |
|---|---|---|---|---|
| **6** | **Transmitter Characteristics** | | | |
| 6.2.2 | UE Maximum output power | | √√ | √√ |
| 6.2.3 | Maximum Power Reduction (MPR) | | √√ | √√ |
| 6.2.4 | Additional Maximum Power Reduction (A-MPR) | | √√*3 | √√ |
| 6.2.5 | Configured UE transmitted output power | | √√*3 | √√ |
| 6.3 | Output power dynamics | | | |
| 6.3.1 | Void | | | |
| 6.3.2 | Minimum output power | | √√ | √√ |
| 6.3.3 | Transmit OFF power | | | |
| 6.3.4 | ON/OFF time mask | | | |
| 6.3.4.1 | General ON/OFF time mask | | X | √√ |
| 6.3.4.2 | PRACH and SRS time mask | | X | √√ |
| 6.3.5 | Power control | | | |
| 6.3.5.1 | Power control absolute power tolerance | | X | √√ |
| 6.3.5.2 | Power control relative power tolerance | | X | √√ |
| 6.3.5.3 | Aggregate power control tolerance | | X | √√ |
| 6.4 | Void | | | |
| 6.5 | Transmit signal quality | | | |
| 6.5.1 | Frequency error | | √√ | √√ |
| 6.5.2 | Transmit modulation | | | |
| 6.5.2.1 | Error Vector Magnitude (EVM) | | √√ | √√ |
| 6.5.2.1A | PUSCH-EVM with exclusion period | | √√ | √√ |
| 6.5.2.2 | Carrier leakage | | √√ | √√ |
| 6.5.2.3 | In-band emissions for non allocated RB | | √√ | √√ |
| 6.5.2.4 | EVM equalizer spectrum flatness | | √√ | √√ |
| 6.6 | Output RF spectrum emissions | | | |
| 6.6.1 | Occupied bandwidth | | √√ | √√ |
| 6.6.2 | Out-of-band emission | | | |
| 6.6.2.1 | Spectrum emission mask | | √√ | √√ |
| 6.6.2.2 | Additional spectrum emission mask | | √√*3 | √√ |
| 6.6.2.3 | Adjacent Channel Leakage power Ratio | | √√ | √√ |
| 6.6.2.4 | Additional ACLR requirements | | | |
| 6.6.3 | Spurious emissions | | | |
| 6.6.3.1 | Transmitter Spurious emissions | Requires external equipment | — | √*2 |
| 6.6.3.2 | Spurious emission band UE co-existence | Requires external equipment | — | √*2 |
| 6.6.3.3 | Additional spurious emissions | Requires external equipment | — | √*2 |
| 6.7 | Transmit intermodulation | Requires external equipment | — | √*2 |
| **7** | **Receiver Characteristics** | | | |
| 7.3 | Reference sensitivity level | | √√*4 | √√ |
| 7.4 | Maximum input level | | √√*4 | √√ |
| 7.5 | Adjacent Channel Selectivity (ACS) | Requires external equipment | √*2 *4 | √*2 |
| 7.6 | Blocking characteristics | | | |
| 7.6.1 | In-band blocking | Requires external equipment | √*2 *4 | √*2 |
| 7.6.2 | Out-of-band blocking | Requires external equipment | √*2 *4 | √*2 |
| 7.6.3 | Narrow band blocking | Requires external equipment | √*2 *4 | √*2 |
| 7.7 | Spurious response | Requires external equipment | √*2 *4 | √*2 |
| 7.8 | Intermodulation characteristics | | | |
| 7.8.1 | Wide band Intermodulation | Requires external equipment | √*2 *4 | √*2 |
| 7.8.2 | Void | | | |
| 7.9 | Spurious emissions | Requires external equipment | X | √*2 |

√√**:** Supported | √**:** Requires external equipment (SPA or SG) | –**:** Measure by SPA | △**:** Future Support | X**:** No Support

*1: Non-Call Processing does not support call processing function. In addition, because Loop Back and UL Power Control of payload data cannot be controlled, UEs must output signals matching test conditions.
*2: This application note does not explain measurement procedures for appropriate test items.
*3: Supports measurements only (broadcast information is fixed).
*4: Outputs DL RMC defined from TS 36.521-1 Annex A Table A.3.2-1 to Table A.3.2-4 in fixed pattern (ARB).
Throughput measurements supported at UE side.

## 1.3. TRX Measurements (Fundamental Measurements)

Sections after 1.3.1 explain how to use the GPIB remote control software commands. For details of GPIB commands and manual operation, read the instruction manual. GPIB commands are in red bold. The UE power class is assumed to be 3.

Connect to Test Mode after UE location registration for measurements after 1.3.6.
Complete Initial Condition Setting (1.3.1), Location Registration, (1.3.2) and Test Mode Connection (1.3.3) before measurement.

### 1.3.1. Initial Condition Setting

Sets Initial Condition Setting before measurement.
Setting when Operating Band is 1. Test Frequency is Mid range, and Test Channel Bandwidth is 5 MHz.

1. Execute **PRESET** to set default parameter.
2. Execute **ULCHAN 18300** to set UL Channel and DL Channel to 18300 and 300, respectively.
3. Execute **BANDWIDTH 5MHZ** to set Channel Bandwidth to 5 MHz.

### 1.3.2. Location Registration

Registers UE location after Initial Condition Setting.

1. Connect UE and MT8820C.
2. Execute **CALLPROC ON** to set call processing ON.
3. Execute **CALLRFR** to clear UE Report and call processing.
4. Execute **CALLSTAT?** to confirm the call processing status.
5. Check the status confirmed in step 4 is 1 (= Idle).
6. Turn on UE power.
7. Execute **CALLSTAT?** to confirm the call processing status.
8. Check that the status confirmed in step 7 is 2 (= Idle (Regist)).
9. (Repeat steps 7 and 8 when the checked status is not 2 (= Idle (Regist)).

### 1.3.3. Test Mode Connection.

Connect to Test Mode after UE location registration. Complete location registration before call processing (→1.3.2).

1. Execute **CALLSA** to connect to Test Mode.
2. Execute **CALLSTATIC?** to confirm the call processing stationary status.
3. Check that the status confirmed in step 2 is 6 (= Connected).

### 1.3.4. Test Mode Disconnection

1. Execute **CALLSO** to disconnect from Test Mode.
2. Execute **CALLSTATIC?** to confirm the call processing stationary status.
3. (Check that the status confirmed in step 2 is 2 (= Idle (Regist)).

### 1.3.5. Broadcast Information Update

When changing broadcast information, the UE must be notified of the change using one of the following methods. The effective method differs according to the UE in use.

**A) Execute RRC Connection Reconfiguration**

Notify the broadcast information update using the RRC Connection Reconfiguration message.
It updates information without ending a call. Use this procedure.

1. Execute **RRCUPDATE RRCMSG** to set radioResourceConfigCommon Update to RRC Message.

***NOTE 1: This setting is required once at the beginning of the measurement sequence.***

**B) Execute Paging**

Notify the broadcast information update using Paging.
It updates information without ending a call. The MT8820C waits until the Paging information is reflected.
Use this procedure when procedure A cannot be used.

Waiting time at MT8820C
modificationPeriodCoeff [n] x defaultPagingCycle [rf = 10 ms]

***NOTE 1: Setting both to the minimum value before position registration minimizes waiting time.***
***(Example) modificationPeriodCoeff (n2) × defaultPagingCycle (rf32) = 640 ms***

1. Execute **RRCUPDATE PAGING** to set radioResourceConfigCommon Update to Paging.

***NOTE 2: This setting is required once at the beginning of measurement sequence.***

**C) Turn UE power OFF and ON**

Turn the UE power OFF and ON to update the broadcast information.
Use this procedure when procedures A and B cannot be used.

1. Disconnect Test Mode (→1.3.4).
2. Turn off UE power.
3. Turn on UE power.
4. Execute **CALLSTAT?** to confirm the call processing status.
5. Check that the status confirmed in step 4 is 2 (= Idle (Regist)).
   Repeat steps 4 and 5 when the status confirmed in step 4 is not 2 (= Idle (Regist)).
6. Connect to Test Mode (→1.3.3).

***NOTE 1: This procedure is required to update broadcast information.***

## 1.3.6. 6.2.2 UE Maximum Output Power

Measures when UL (Modulation, RB) is (QPSK, 1RB) or (QPSK, PartialRB).
An example for 20 measurements is displayed.

[Common setting]
1. Execute **PWR_AVG 20** to set the average count of power measurement to 20 times.
2. Connect to Test Mode (→1.3.3).

[(QPSK, 1RB) measurements]
3. Execute **TESTPRM TX_MAXPWR_Q_1** to set Test Parameter to TX1 - Max. Power (QPSK/1RB).
4. Execute **ULRB_POS MIN** to set UL RB Position to Min (#0).
5. Execute **SWP** to measure power.
6. Execute **POWER? AVG** to read the TX power measurement result.
7. Execute **POWERPASS?** to check that the TX power measurement Pass/Fail judgment is Pass.
8. Execute **ULRB_POS MAX** to set UL RB Position to Max (#max).
9. Execute steps 5 to 7.

[(QPSK, PartialRB) measurements]
10. Execute **TESTPRM TX_MAXPWR_Q_P** to set Test Parameter to TX1 - Max. Power (QPSK/PartialRB).
11. Execute **ULRB_POS MIN** to set UL RB Position to Min (#0).
12. Execute steps 5 to 7.

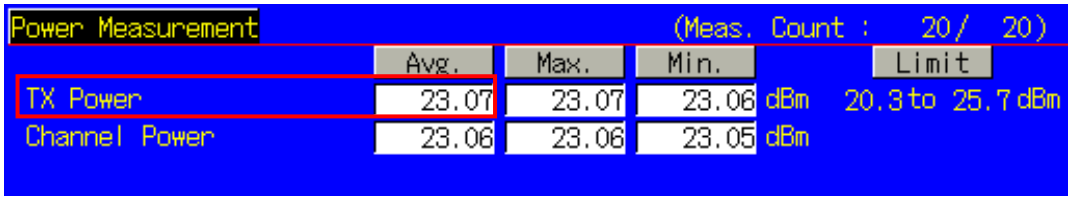
***NOTE 1: At 1RB allocation, Min (#0), Mid (#Nrb/2), and Max (#max) used in this application note each correspond with RB #0, RB #[$N_{RB}^{UL}$ / 2] and RB #max, respectively, described in TS 36.521-1.***

***NOTE 2: At PartialRB allocation Min (#0) and Max (#max), used in this application note each correspond with RB #0 and RB# (max +1 - RB allocation),respectively, described in TS 36.521-1.***

***NOTE 3: The 1RB allocation UL RB Position is divided as follows***

***When $BW_{Channel} > \Delta_{TC}$, Min (#0) and Max (#max)***
***When $BW_{Channel} \leq \Delta_{TC}$, Min (#0)***
***When $BW_{Channel} = (F_{UL\_high} - F_{UL\_low})$, Min (#0), Mid (#Nrb/2) and Max (#max)***

***NOTE 4: The UL RB Position of PartialRB allocation is Min (#0).***




**Example of measurement result when Test Parameter is TX1 - Max. Power (QPSK/1RB).**

## 1.3.7. 6.2.3 Maximum Power Reduction (MPR)

Measures when UL (Modulation, RB) is (QPSK, FullRB), (16QAM, PartialRB) or (16QAM, FullRB).
An example for 20 measurements is displayed.

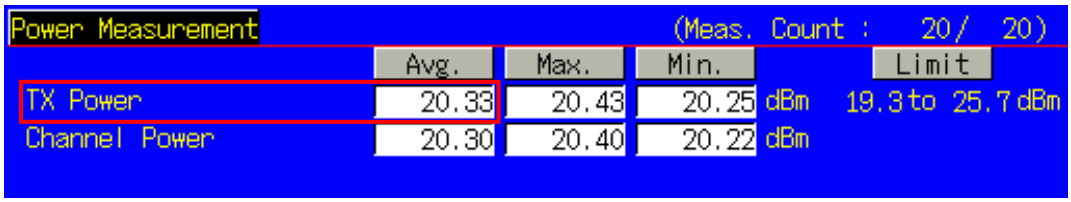
[Common Setting]
1. Execute **PWR_AVG 20** to set the average count of power measurement to 20 times.
2. Connect to Test Mode (→1.3.3).

[(QPSK, FullRB) measurements]
3. Execute **TESTPRM TX_MAXPWR_Q_F** to set Test Parameter to TX1 - Max. Power (QPSK/FullRB).
4. Execute **SWP** to measure power.
5. Execute **POWER? AVG** to read the TX power measurement result.
6. Execute **POWERPASS?** to check that the TX power measurement Pass/Fail judgment is Pass.

[(16QAM, PartialRB) measurements]
7. Execute **TESTPRM TX_MAXPWR_16_P** to set Test Parameter to TX1 - Max. Power (16QAM/PartialRB).
8. Execute **ULRB_POS MIN** to set UL RB Position to Min (#0).
9. Execute steps 4 to 6.

[(16QAM, FullRB) measurements]
10. Execute **TESTPRM TX_MAXPWR_16_F** to set Test Parameter to TX1 - Max. Power (16QAM/FullRB).
11. Execute steps 4 to 6.

***NOTE 1: The UL RB Position of PartialRB allocation is Min (#0).***




**Example of measurement result when Test Parameter is TX1 - Max. Power (QPSK/FullRB).**

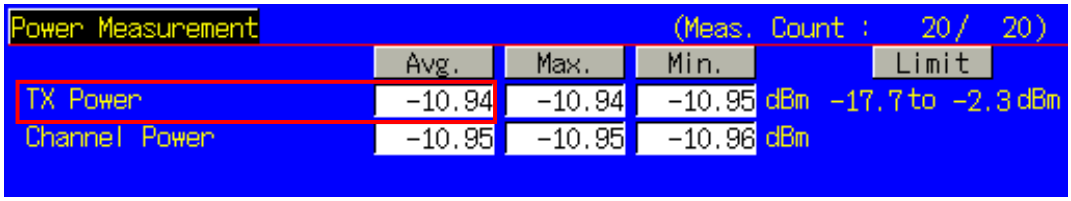
## 1.3.8. 6.2.5 Configured UE Transmitted Output Power

Measures when UL (Modulation, RB) is (QPSK, PartialRB).
An example for 20 measurements is displayed.

[Common Setting]
1. Execute **PWR_AVG 20** to set the average count of power measurement to 20 times.
2. Connect to Test Mode (→1.3.3).

[(QPSK, PartialRB) measurements]
3. Execute **TESTPRM TX_CONF_PWR1** to set Test Parameter to TX2 - Configured Power (Test Point 1). (Confirm that the broadcast information change is reflected at the UE →1.3.5.)
4. Execute **SWP** to measure power
5. Execute **POWER? AVG** to read the TX power measurement result.
6. Execute **POWERPASS?** to check that the TX power measurement Pass/Fail judgment is Pass.
7. Execute **TESTPRM TX_CONF_PWR2** to set Test Parameter to TX2 - Configured Power (Test Point 2). (Confirm that the broadcast information change is reflected at the UE →1.3.5.)
8. Execute steps 4 to 6.
9. Execute **TESTPRM TX_CONF_PWR3** to set Test Parameter to TX2 - Configured Power (Test Point 3). (Confirm that the broadcast information change is reflected at the UE →1.3.5.)
10. Execute steps 4 to 6.

***NOTE 1: The UL RB Position of PartialRB allocation is Min (#0).***



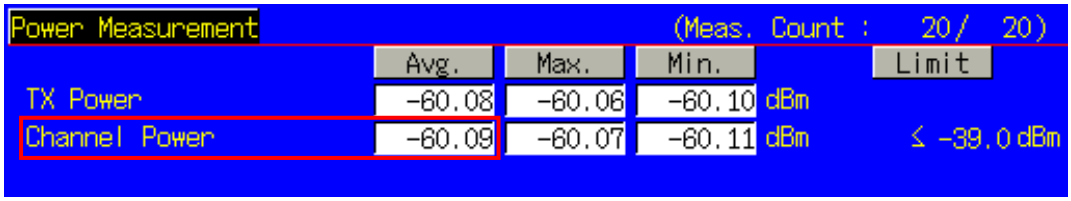

**Example of measurement result when Test Parameter is TX2 - Configured Power (Test Point 1).**

## 1.3.9. 6.3.2 Minimum Output Power

Measures when UL (Modulation, RB) is (QPSK, FullRB).
An example for 20 measurements is displayed.

[Common Setting]
1. Execute **PWR_AVG 20** to set the average count of power measurement to 20 times.
2. Connect to Test Mode (→1.3.3).

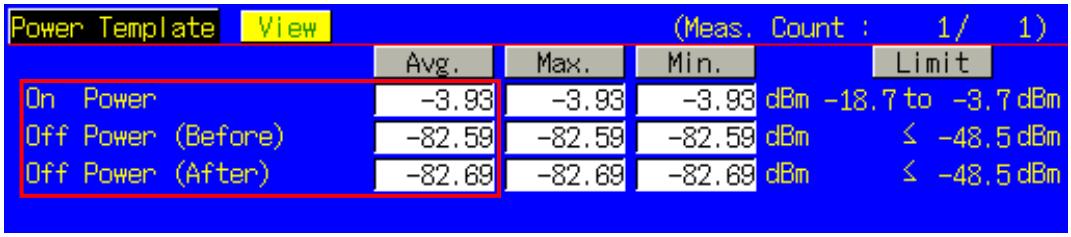
[(QPSK, FullRB) measurements]
3. Execute **TESTPRM TX_MINPWR** to set Test Parameter to TX1 - Min. Power.
4. Execute **SWP** to measure power.
5. Execute **CHPWR? AVG** to read the Channel Power measurement result.
6. Execute **CHPWRPASS?** to check that the Channel Power measurement Pass/Fail judgment is Pass.




**Example of measurement result when Test Parameter is TX1 - Min. Power.**

### 1.3.10. 6.3.4.1 General ON/OFF Time Mask

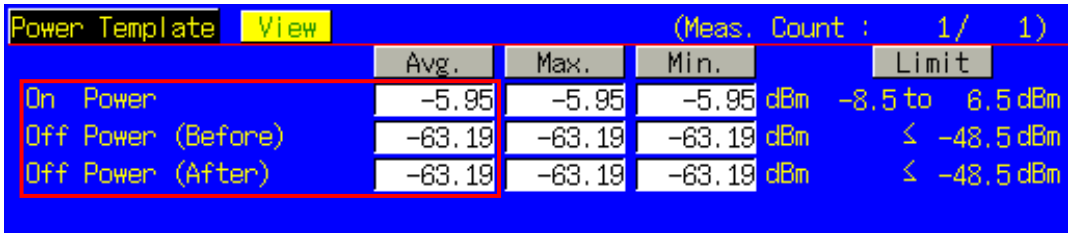
1. Connect to Test Mode (→1.3.3).
2. Execute **TESTPRM TX_GEN_TMASK** to set Test Parameter to TX2 - General Time Mask.
   (Confirm that the broadcast information change is reflected at the UE →1.3.5.)
3. Execute **PT_WDR ON** to enable Power Template wide dynamic range measurement.
4. Execute **SWP** to perform Power Template measurement.
5. Execute **ONPWR? AVG** to read the On Power measurement result.
6. Execute **ONPWRPASS?** to check that the On Power measurement Pass/Fail judgment is Pass.
7. Execute **OFFPWR_BEFORE? AVG** to read the Off Power (Before) measurement result.
8. Execute **OFFPWR_AFTER? AVG** to read the Off Power (After) measurement result.
9. Execute **OFFPWRPASS?** to check that the Off Power measurement Pass/Fail judgment is Pass.




**Example of measurement result when Test Parameter is TX2 - General Time Mask.**

### 1.3.11. 6.3.4.2 PRACH and SRS Time Mask

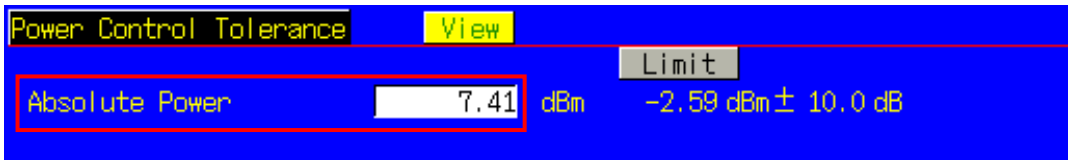
1. Connect to Test Mode (→1.3.3).
2. Execute **TESTPRM IDLE_PRACH_TMASK** to set Test Parameter to Idle/Call - PRACH Time Mask.
   (Confirm that the broadcast information change is reflected at the UE →1.3.5.)
3. Execute **SWP** to perform Power Template (PRACH) measurement.
4. Execute **ONPWR? AVG** to read the On Power measurement result.
5. Execute **ONPWRPASS?** to check the On Power measurement Pass/Fail judgment is Pass.
6. Execute **OFFPWR_BEFORE? AVG** to read the Off Power (Before) measurement result.
7. Execute **OFFPWR_AFTER? AVG** to read the Off Power (After) measurement result.
8. Execute **OFFPWRPASS?** to check that the Off Power measurement Pass/Fail judgment is Pass.




**Example of measurement result when Test Parameter is Idle/Call - PRACH Time Mask.**

## 1.3.12. 6.3.5.1 Power Control Absolute Power Tolerance

1. Connect to Test Mode(→1.3.3)
2. Execute **TESTPRM TX_PCTABS1** to set Test Parameter to TX3 - Absolute Power (Test Point1).
   (Confirm that the broadcast information change is reflected at the UE →1.3.5.)
3. Execute **SWP** to perform Power Control Tolerance (Absolute Power) measurement.
4. Execute **PCTPWR?** to read the Absolute Power (dBm) measurement result.
5. Execute **PCTPASS?** to check that the Absolute Power measurement Pass/Fail judgment is Pass.
6. Execute **TESTPRM TX_PCTABS2** to set Test Parameter to TX3 - Absolute Power (Test Point2).
   (Confirm that the broadcast information change is reflected at the UE →1.3.5.)
7. Execute steps 3 to 5.




**Example of measurement result when Test Parameter is TX3 - Absolute Power(Test Point1).**

## 1.3.13. 6.3.5.2 Power Control Relative Power Tolerance

1. Connect to Test Mode (→1.3.3).
2. Execute **TESTPRM TX_PCTREL_UP_A** to set Test Parameter to TX3 - Relative Power (Ramping UP A).
3. Execute **SWP** to perform Power Control Tolerance (Relative Power) measurement.
4. Execute **PCTPWR?** to read the Relative Power (dB) measurement result.
5. Execute **PCTPASS?** to check that the Relative Power measurement Pass/Fail judgment is Pass.
6. Execute **TESTPRM TX_PCTREL_UP_B** to set Test Parameter to TX3 - Relative Power (Ramping UP B).
7. Execute steps 3 to 5.
8. Execute **TESTPRM TX_PCTREL_UP_C** to set Test Parameter to TX3 - Relative Power (Ramping UP C).
9. Execute steps 3 to 5.
10. Execute **TESTPRM TX_PCTREL_DOWN_A** to set Test Parameter to TX3 - Relative Power (Ramping Down A).
11. Execute steps 3 to 5.
12. **TESTPRM TX_PCTREL_DOWN_B** to set Test Parameter to TX3 - Relative Power (Ramping Down B).
13. Execute steps 3 to 5.
14. **TESTPRM TX_PCTREL_DOWN_C** to set Test Parameter to TX3 - Relative Power (Ramping Down C).
15. Execute steps 3 to 5.
16. **TESTPRM TX_PCTREL_ALT** to set Test Parameter to TX3 - Relative Power (Alternating).
17. Execute steps 3 to 5.


**Example of measurement result when Test Parameter is TX3 - Relative Power (Sub-test A).**

## 1.3.14. 6.3.5.3 Aggregate Power Control Tolerance

1. Connect to Test Mode (→1.3.3).
2. Execute **TESTPRM TX_PCTAGG_PUSCH** to set Test Parameter to TX3 - Aggregate Power (PUSCH Sub-test).
3. Execute **SWP** to perform Power Control Tolerance (Aggregate Power) measurement.
4. Execute **PCTPWR?** to read the Aggregate Power (dB) measurement result.
5. Execute **PCTPASS?** to check that the Aggregate Power measurement Pass/Fail judgment is Pass.
6. Execute **TESTPRM TX_PCTAGG_PUCCH** to set Test Parameter to TX3 - Aggregate Power (PUCCH Sub-test).
7. Execute steps 3 to 5.

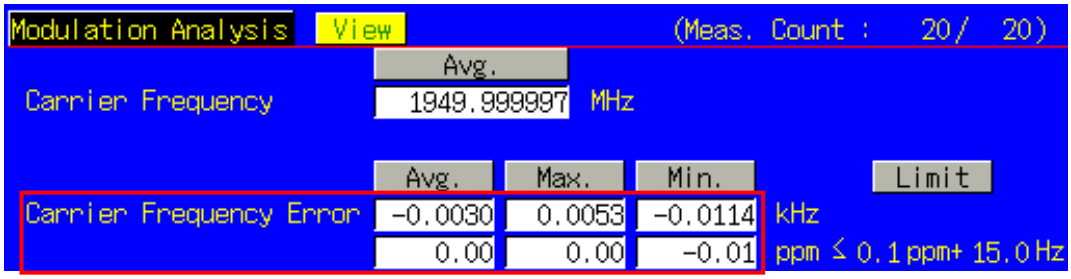

**Example of measurement result when Test Parameter is TX3 - Aggregate Power (PUSCH Sub-test).**

## 1.3.15. 6.5.1 Frequency Error

Measures when UL(Modulation, RB) is (QPSK, FullRB).
An example for 20 measurements is displayed.

[Common Setting]
1. Execute **MOD_AVG 20** to set the average count of Modulation Analysis to 20 times.
2. Connect to Test Mode (→1.3.3).

[(QPSK, FullRB) measurements]
3. Execute **TESTPRM RX_SENS** to set Test Parameter to RX – Ref. Sens./Freq. Error.
4. Execute **SWP** to perform Modulation Analysis measurement.
5. Execute **WORST_CARRFERR? HZ** to read the Carrier Frequency Error (1 = 0.1 Hz) measurement result.
6. Execute **WORST_CARRFERR? PPM** to read the Carrier Frequency Error (1 = 0.01 ppm) measurement result.
7. Execute **CARRFERRPASS?** to check that the Carrier Frequency Error Pass/Fail judgment is Pass.




**Example of measurement result when Test Parameter is RX – Ref. Sens./Freq. Error.**

## 1.3.16. 6.5.2.1 Error Vector Magnitude (EVM) - PUSCH

Measures when UL (Modulation, RB) is (QPSK, PartialRB), (QPSK, FullRB), (16QAM, PartialRB) or (16QAM, FullRB).
An example for 20 measurements is displayed.

[Common Setting]
1. Execute **MOD_AVG 20** to set the average count of Modulation Analysis to 20 times.
2. Connect to Test Mode (→1.3.3).

[(QPSK, PartialRB) measurements]
3. Execute **TESTPRM TX_MAXPWR_Q_P** to set Test Parameter to TX1 - Max. Power (QPSK/PartialRB).
4. Execute **ULRB_POS MIN** to set UL RB Position to Min (#0).
5. Execute **SWP** to perform Modulation Analysis measurement.
6. Execute **EVM? AVG** to read the EVM measurement result.
7. Execute **EVMPASS?** to check that the EVM Pass/Fail judgment is Pass.
8. Execute **RSEVM? AVG** to read the Reference Signal EVM measurement result.
9. Execute **RSEVMPASS?** to check that the Reference Signal EVM Pass/Fail judgment is Pass.
10. Execute **ULRB_POS MAX** to set the UL RB Position to Max (#max).
11. Execute steps 5 to 9.
12. Execute **TESTPRM TX_M40DBM_Q_P** to set Test Parameter to TX1 - EVM/IBE/LEAK @ -40 dBm (QPSK/PartialRB)
13. Execute steps 4 to 11.

[(QPSK, FullRB) measurements]
14. Execute **TESTPRM TX_MAXPWR_Q_F** to set Test Parameter to TX1 - Max. Power (QPSK/FullRB).
15. Execute steps 5 to 9.
16. Execute **TESTPRM TX_M40DBM_Q_F** to set Test Parameter to TX1 - EVM @ -40 dBm (QPSK/Full RB).
17. Execute steps 5 to 9.

[(16QAM, PartialRB) measurements]
18. Execute **TESTPRM TX_MAXPWR_16_P** to set Test Parameter to TX1 - Max. Power (16QAM/PartialRB).
19. Execute steps 4 to 11.
20. Execute **TESTPRM TX_M40DBM_16_P** to set Test Parameter to TX1 - EVM @ -40 dBm (16QAM/Partial RB).
21. Execute steps 4 to 11.

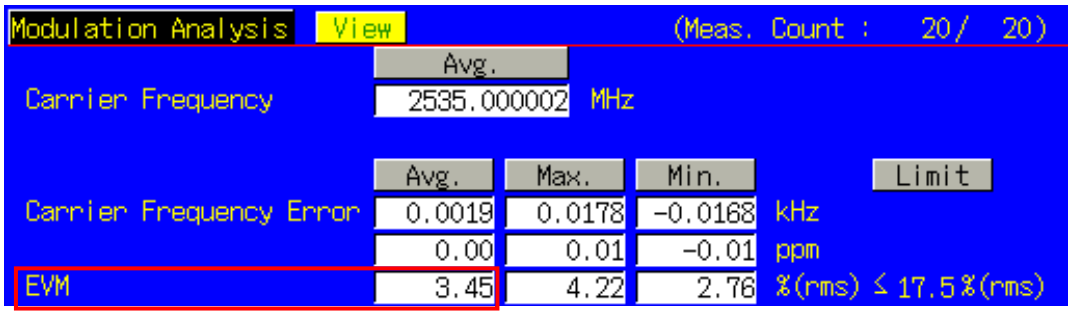
[(16QAM, FullRB) measurements]
22. Execute **TESTPRM TX_MAXPWR_16_F** to set Test Parameter to TX1 - Max. Power (16QAM/FullRB).
23. Execute steps 5 to 9.
24. Execute **TESTPRM TX_M40DBM_16_F** to set Test Parameter to TX1 - EVM @ -40 dBm (16QAM/Full RB).
25. Execute steps 5 to 9.

***NOTE 1: The UL RB Position of PartialRB allocation is Min (#0) or Max (#max).***

## 1.3.17. 6.5.2.1 Error Vector Magnitude (EVM) - PUCCH

An example for 20 measurements is displayed.

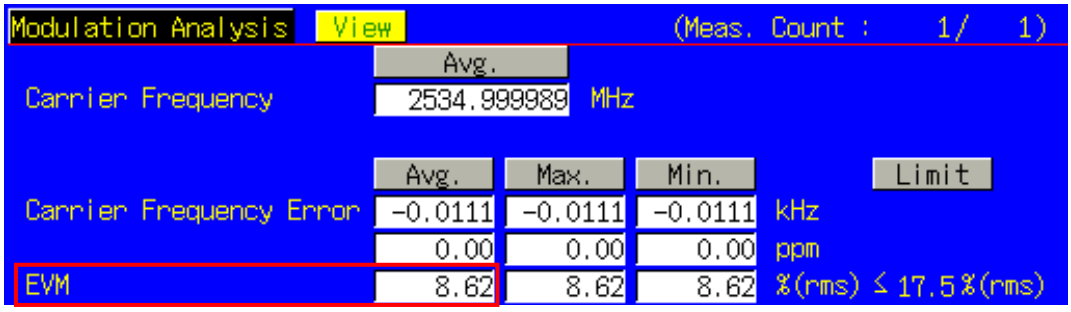
1. Execute **MOD_AVG 20** to set the average count of Modulation Analysis to 20 times.
2. Connect to Test Mode (→1.3.3).
3. Execute **TESTPRM TX_PUCCH_MAX** to set Test Parameter to TX2 - PUCCH EVM @MAX.
4. Execute **SWP** to perform Modulation Analysis measurement.
5. Execute **EVM? AVG** to read the EVM measurement result.
6. Execute **EVMPASS?** to check that the EVM Pass/Fail judgment is Pass.
7. Execute **TESTPRM TX_PUCCH_M40DBM** to set Test Parameter to TX2 - PUCCH EVM/IBE @ -40 dBm.
8. Execute steps 4 to 6.




**Example of measurement result when Test Parameter is TX2 - PUCCH EVM @ MAX.**

## 1.3.18. 6.5.2.1 Error Vector Magnitude (EVM) – PRACH

1. Execute **TESTPRM IDLE_PRACHEVM1** to set Test Parameter to Idle - PRACH EVM (Test Point1).
   (Confirm that the broadcast information change is reflected at the UE →1.3.5.)
2. Connect to Test Mode (→1.3.3).
3. Execute **SWP** to perform Modulation Analysis (PRACH) measurement.
4. Execute **EVM? AVG** to read the EVM measurement result.
5. Execute **EVMPASS?** to check that the EVM Pass/Fail judgment is Pass.
6. Execute **TESTPRM IDLE_PRACHEVM2** to set Test Parameter to Idle/Call - PRACH EVM (Test Point2).
   (Confirm that the broadcast information change is reflected at the UE →1.3.5.)
7. Execute steps 3 to 5.




**Example of measurement result when Test Parameter is Idle/Call - PRACH EVM (Test Point1).**

## 1.3.19. 6.5.2.1A PUSCH-EVM with exclusion period

Measures using the 10 MHz Channel Bandwidth defined in the measurement standards.
Set the average measurement count to 16 times because the average for 16 timeslots is described in the standards.
Examples are shown for when UL (Modulation) is (QPSK) or (16QAM).

[Common Setting]

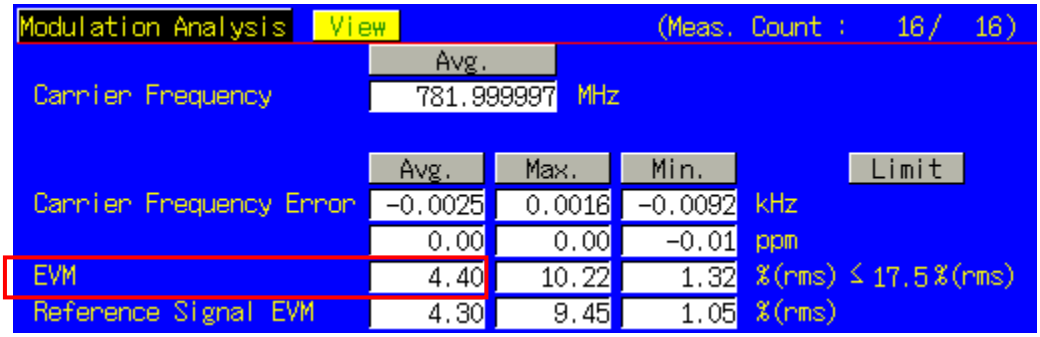
1. Execute **BANDWIDTH 10MHZ** to set Channel Bandwidth to 10 MHz.
2. Execute **MOD_AVG 16** to set the average count of Modulation Analysis to 16 times.
3. Connect to Test Mode (→1.3.3).

[(QPSK) measurements]

4. Execute **TESTPRM TX_EVMEXP_Q** to set Test Parameter to TX3 - EVM with Exclusion Period (QPSK).
5. Execute **SWP to perform** Modulation Analysis measurement.
6. Execute **EVM? AVG** to read the EVM measurement result.
7. Execute **EVMPASS? To check that the** EVM Pass/Fail judgement is Pass.
8. Execute **RSEVM? AVG** to read the Reference Signal EVM measurement result.
9. Execute **RSEVMPASS?** to check that the Reference Signal EVM Pass/Fail judgement is Pass.

[(16QAM) measurements]

10. Execute **TESTPRM TX_EVMEXP_16** to set Test Parameter to TX3 - EVM with Exclusion Period (16QAM).
11. Execute steps 5 to 9.




**Example of measurement result when Test Parameter is TX3 – EVM with Exclusion Period (QPSK).**

### 1.3.20. 6.5.2.2 Carrier Leakage

Measures when UL (Modulation, RB) is (QPSK, PartialRB).
An example for 20 measurements is displayed.

[Common Setting]
1. Execute **MOD_AVG 20** to set the average count of Modulation Analysis to 20 times.
2. Connect to Test Mode (→1.3.3).

[(QPSK, PartialRB) measurements]
3. Execute **TESTPRM TX_0DBM** to set Test Parameter to TX1 - IBE/LEAK @ 0 dBm.
4. Execute **ULRB_POS MIN** to set UL RB Position to Min (#0).
5. Execute **SWP** to perform Modulation Analysis measurement.
6. Execute **CARRLEAK? MAX** to read the Carrier Leakage measurement result.
7. Execute **CARRLEAKPASS?** to check that the Carrier Leakage Pass/Fail judgment is Pass.
8. Execute **ULRB_POS MAX** to set UL RB Position to Max (#max)
9. Execute steps 5 to 7.
10. Execute **TESTPRM TX_M30DBM** to set Test Parameter to TX1 - IBE/LEAK @ -30 dB.
11. Execute steps 4 to 9.
12. Execute **TESTPRM TX_M40DBM_Q_P** to set Test Parameter to TX1 - EVM/IBE/LEAK @ -40 dBm (QPSK/PartialRB).
13. Execute steps 4 to 9.

***NOTE 1: The UL RB Position of PartialRB allocation is Min (#0) or Max (#max).***

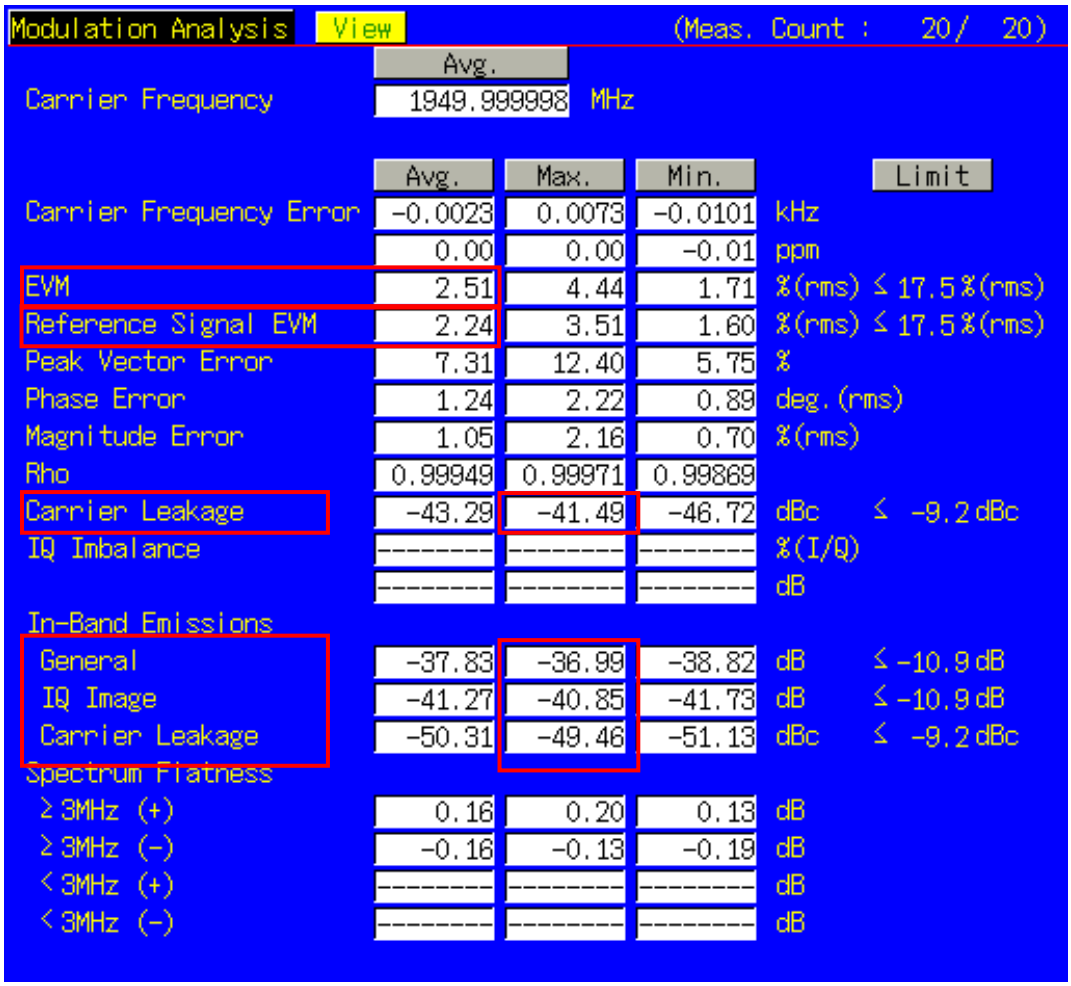
### 1.3.21. 6.5.2.3 In-band Emissions for Non Allocated RB – PUSCH

Measures when UL (Modulation, RB) is (QPSK, PartialRB).
An example for 20 measurements is displayed.

[Common Setting]
1. Execute **MOD_AVG 20** to set the average count of Modulation Analysis to 20 times.
2. Connect to Test Mode (→1.3.3).

[(QPSK, PartialRB) measurements]
3. Execute **TESTPRM TX_0DBM** to set Test Parameter to TX1 - IBE/LEAK @ 0 dBm.
4. Execute **ULRB_POS MIN** to set UL RB Position to Min (#0).
5. Execute **SWP** to perform Modulation Analysis measurements.
6. Execute **INBANDE_GEN? MAX** to read the In-Band Emissions (General) measurement result.
7. Execute **INBANDE_IMG? MAX** to read the In-Band Emissions (IQ Image) measurement result.
8. Execute **INBANDE_LEAK? MAX** to read the In-Band Emissions (Carrier Leakage) measurement result.
9. Execute **INBANDEPASS?** to check that the In-Band Emissions の Pass/Fail judgment is Pass.
10. Execute **ULRB_POS MAX** to set UL RB Position to Max (#max).
11. Execute steps 5 to 9.
12. **TESTPRM TX_M30DBM** to set Test Parameter to TX1 - IBE/LEAK @ -30 dBm.
13. Execute steps 4 to 11.
14. Execute **TESTPRM TX_M40DBM_Q_P** to set Test Parameter to TX1 - EVM/IBE/LEAK @ -40 dBm (QPSK/PartialRB).
15. Execute steps 4 to 11.

***NOTE 1: The UL RB Position of PartialRB allocation is Min (#0) or Max (#max).***




**Example of measurement result when Test Parameter is TX1 - EVM/IBE/LEAK @ -40 dBm (QPSK/PartialRB).**

## 1.3.22. 6.5.2.3 In-band Emissions for Non Allocated RB – PUCCH

An example for 20 measurements is displayed.

1. Execute **MOD_AVG 20** to set the average count of Modulation Analysis to 20 times.
2. Connect to Test Mode (→1.3.3).
3. Execute **TESTPRM TX_PUCCH_0DBM** to set Test Parameter to TX2 - PUCCH IBE @ 0 dBm.
4. Execute **SWP** to perform Modulation Analysis measurement.
5. Execute **INBANDE_GEN? MAX** to read the In-Band Emissions (General) measurement result.
6. Execute **INBANDE_IMG? MAX** to read the In-Band Emissions (IQ Image) measurement result.
7. Execute **INBANDE_LEAK? MAX** to read the In-Band Emissions (Carrier Leakage) measurement result.
8. Execute **INBANDEPASS?** to check that the In-Band Emissions Pass/Fail judgment is Pass.
9. Execute **TESTPRM TX_PUCCH_M30DBM** to set Test Parameter to TX2 - PUCCH IBE @ -30 dBm.
10. Execute steps 4 to 8.
11. Execute **TESTPRM TX_PUCCH_M40DBM** to set Test Parameter to TX2 - PUCCH EVM/IBE @ -40 dBm.
12. Execute steps 4 to 8.

***NOTE 1: The UL RB Position of PartialRB allocation is Min (#0) or Max (#max).***

Modulation Analysis View (Meas. Count : 20/ 20)

| | Avg. | | | | |
|---|---|---|---|---|---|
| Carrier Frequency | 2534.999998 | MHz | | | |
| | Avg. | Max. | Min. | | Limit |
| Carrier Frequency Error | -0.0025 | 0.0049 | -0.0144 | kHz | |
| | 0.00 | 0.00 | -0.01 | ppm | |
| EVM | 1.38 | 3.19 | 0.79 | %(rms) | |
| Reference Signal EVM | -------- | -------- | -------- | %(rms) | |
| Peak Vector Error | 2.89 | 6.95 | 1.63 | % | |
| Phase Error | 0.58 | 1.50 | 0.33 | deg.(rms) | |
| Magnitude Error | 0.84 | 1.93 | 0.57 | %(rms) | |
| Rho | 0.99987 | 0.99994 | 0.99956 | | |
| Carrier Leakage | -33.19 | -31.14 | -35.18 | dBc | |
| IQ Imbalance | 99.95 | 100.06 | 99.78 | %(I/Q) | |
| | -62.94 | -53.30 | -77.94 | dB | |
| In-Band Emissions | | | | | |
| General | -52.64 | -51.67 | -53.34 | dB | ≤ -29.2 dB |
| IQ Image | -54.61 | -53.39 | -55.92 | dB | ≤ -24.2 dB |
| Carrier Leakage | -52.79 | -49.03 | -54.73 | dBc | ≤ -24.2 dBc |
| Spectrum Flatness | | | | | |
| ≥ 3MHz (+) | 0.06 | 0.11 | 0.03 | dB | |
| ≥ 3MHz (-) | -0.06 | -0.03 | -0.12 | dB | |
| < 3MHz (+) | -------- | -------- | -------- | dB | |
| < 3MHz (-) | -------- | -------- | -------- | dB | |

**Example of measurement result when Test Parameter is TX2 - PUCCH IBE @ 0 dBm.**

## 1.3.23. 6.5.2.4 EVM Equalizer Spectrum Flatness

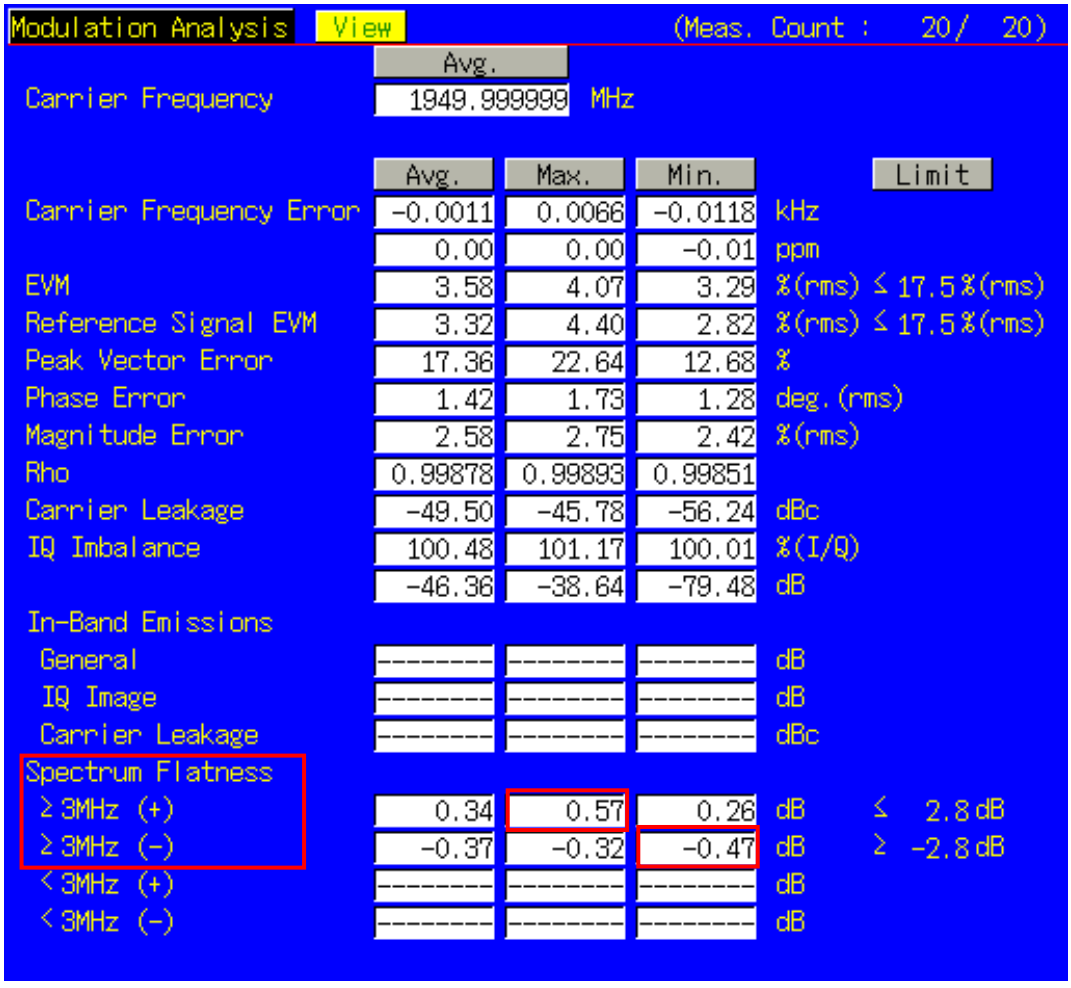
Measures when UL (Modulation, RB) is (QPSK, FullRB).
An example for 20 measurements is displayed.

[Common Setting]

1. Execute **MOD_AVG 20** to set the average count of Modulation Analysis to 20 times.
2. Connect to Test Mode (→1.3.3).

[(QPSK, FullRB) measurements]

3. Execute **TESTPRM TX_MAXPWR_Q_F** to set Test Parameter to TX1 - Max. Power (QPSK/FullRB).
4. Execute **SWP** to perform Modulation Analysis measurement.
5. Execute **SPECFLAT_RP1? MAX** to read the MAX Spectrum Flatness (Spectrum Flatness ≥ 3 MHz(PR1)) measurement result.
6. Execute **SPECFLAT_RP2? MAX** to read the MAX Spectrum Flatness (Spectrum Flatness < 3 MHz(PR2)) measurement result.
7. Execute **SPECFLAT_RP12? MAX** to read the MAX Spectrum Flatness (Spectrum Flatness RP12) measurement result.
8. Execute **SPECFLAT_RP21? MAX** to read the MAX Spectrum Flatness (Spectrum Flatness RP21) measurement result.
9. Execute **SPECFLATPASS?** to check that the Spectrum Flatness Pass/Fail judgment is Pass.



Modulation Analysis | View | (Meas. Count : 20/ 20)

| | Avg. | Max. | Min. | | Limit |
|---|---|---|---|---|---|
| Carrier Frequency | 1949.999999 | | | MHz | |
| Carrier Frequency Error | -0.0011 | 0.0066 | -0.0118 | kHz | |
| | 0.00 | 0.00 | -0.01 | ppm | |
| EVM | 3.58 | 4.07 | 3.29 | %(rms) | ≤ 17.5%(rms) |
| Reference Signal EVM | 3.32 | 4.40 | 2.82 | %(rms) | ≤ 17.5%(rms) |
| Peak Vector Error | 17.36 | 22.64 | 12.68 | % | |
| Phase Error | 1.42 | 1.73 | 1.28 | deg.(rms) | |
| Magnitude Error | 2.58 | 2.75 | 2.42 | %(rms) | |
| Rho | 0.99878 | 0.99893 | 0.99851 | | |
| Carrier Leakage | -49.50 | -45.78 | -56.24 | dBc | |
| IQ Imbalance | 100.48 | 101.17 | 100.01 | %(I/Q) | |
| | -46.36 | -38.64 | -79.48 | dB | |
| In-Band Emissions | | | | | |
| General | -------- | -------- | -------- | dB | |
| IQ Image | -------- | -------- | -------- | dB | |
| Carrier Leakage | -------- | -------- | -------- | dBc | |
| Spectrum Flatness | | | | | |
| ≥ 3MHz (+) | 0.34 | 0.57 | 0.26 | dB | ≤ 2.8 dB |
| ≥ 3MHz (-) | -0.37 | -0.32 | -0.47 | dB | ≥ -2.8 dB |
| < 3MHz (+) | -------- | -------- | -------- | dB | |
| < 3MHz (-) | -------- | -------- | -------- | dB | |

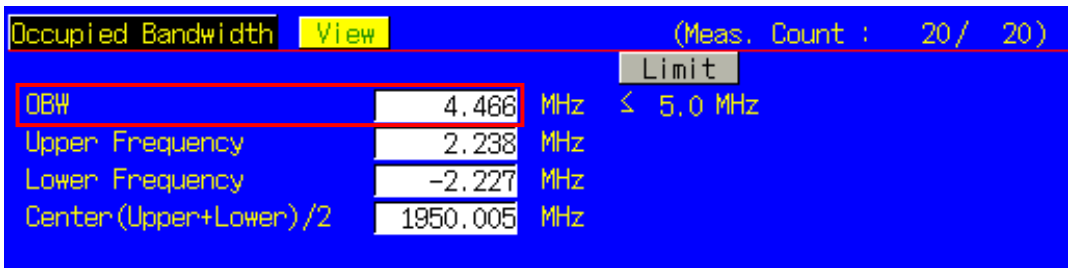
**Example of measurement result when Test Parameter is TX1 - Max. Power (QPSK/FullRB).**

## 1.3.24. 6.6.1 Occupied Bandwidth

Measures when UL (Modulation, RB) is (QPSK, FullRB).
An example for 20 measurements is displayed.

[Common Setting]
1. Execute **OBW_AVG 20** to set the average count of Occupied Bandwidth to 20 times.
2. Connect to Test Mode (→1.3.3).

[(QPSK, FullRB) measurements]
3. Execute **TESTPRM TX_MAXPWR_Q_F** to set Test Parameter to TX1 - Max. Power (QPSK/FullRB).
4. Execute **SWP** to perform Occupied Bandwidth measurements.
5. Execute **OBW?** to read the OBW measurement result.
6. Execute **OBWPASS?** to check that the OBW Pass/Fail judgment is Pass.




**Example of measurement result when Test Parameter is TX1 - Max. Power (QPSK/FullRB).**

## 1.3.25. 6.6.2.1 Spectrum Emission Mask

Measures when UL (Modulation, RB) is (QPSK, PartialRB), (QPSK, FullRB), (16QAM, PartialRB) or (16QAM, FullRB). An example for 20 measurements is displayed.

[Common Setting]
1. Execute **SEM_AVG 20** to set the average count of Spectrum Emission Mask to 20 times.
2. Connect to Test Mode (→1.3.3).

[(QPSK, PartialRB) measurements]
3. Execute **TESTPRM TX_MAXPWR_Q_P** to set Test Parameter to TX1 - Max. Power (QPSK/PartialRB).
4. Execute **ULRB_POS MIN** to set UL RB Position to Min (#0).
5. Execute **SWP** to perform Spectrum Emission Mask measurement.
6. Execute **SEMPASS?** to check that the SEM Pass/Fail judgment is Pass.
7. Execute **ULRB_POS MAX** to set UL RB Position to Max (#max).
8. Execute steps 5 to 6.

[(QPSK, FullRB) measurements]
9. Execute **TESTPRM TX_MAXPWR_Q_F** to set Test Parameter to TX1 - Max. Power (QPSK/FullRB).
10. Execute steps 5 to 6.

[(16QAM, PartialRB) measurements]
11. Execute **TESTPRM TX_MAXPWR_16_P** to set Test Parameter to TX1 - Max. Power (16QAM/PartialRB)).
12. Execute steps 4 to 8.

[(16QAM, FullRB) measurements]
13. Execute **TESTPRM TX_MAXPWR_16_F** to set Test Parameter to TX1 - Max. Power (16QAM/FullRB).
14. Execute steps 5 to 6.

***NOTE 1: The PartialRB allocation UL RB Position is divided as follows***

***When Test Frequency is Low range, Max (#max)***
***When Test Frequency is Mid range, Min (#0) and Max (#max)***
***When Test Frequency is High range, Min (#0)***

Spectrum Emission Mask View (Meas. Count : 20/ 20)

Worst Value of Each Frequency Range

| Frequency Range | Level | | Mask Margin | | Frequency | |
|---|---|---|---|---|---|---|
| Lower | | | | | | |
| 0.0 to 1.0 MHz | -22.02 | dBm | -8.52 | dB | -0.015 | MHz |
| 1.0 to 5.0 MHz | -21.80 | dBm | -13.30 | dB | -1.500 | MHz |
| 5.0 to 6.0 MHz | -35.10 | dBm | -23.60 | dB | -5.500 | MHz |
| 6.0 to 10.0 MHz | -35.67 | dBm | -12.17 | dB | -6.500 | MHz |
| Upper | | | | | | |
| 0.0 to 1.0 MHz | -45.13 | dBm | -31.63 | dB | 0.985 | MHz |
| 1.0 to 5.0 MHz | -30.11 | dBm | -21.61 | dB | 2.000 | MHz |
| 5.0 to 6.0 MHz | -35.18 | dBm | -23.68 | dB | 5.500 | MHz |
| 6.0 to 10.0 MHz | -34.72 | dBm | -11.22 | dB | 9.500 | MHz |
| Template Judgement | Pass | | | | | |

**Example of measurement result when Test Parameter is TX1 - Max. Power (QPSK/PartialRB).**

## 1.3.26. Adjacent Channel Leakage Power Ratio

Measures when UL (Modulation, RB) is (QPSK, PartialRB), (QPSK, FullRB), (16QAM, PartialRB) or (16QAM, FullRB). An example for 20 measurements is displayed.

[Common Setting]
1. Execute **ACLR_AVG 20** to set the average count of Adjacent Channel Power to 20 times.
2. Connect to Test Mode (→1.3.3).

[(QPSK, PartialRB) measurements]
3. Execute **TESTPRM TX_MAXPWR_Q_P** to set Test Parameter to TX1 - Max. Power (QPSK/PartialRB).
4. Execute **ULRB_POS MIN** to set UL RB Position to Min (#0).
5. Execute **SWP** to perform Adjacent Channel Power measurement.
6. Execute **MODPWRPASS?** to check that the ACLR Pass/Fail judgment is Pass.
7. Execute **ULRB_POS MAX** to set UL RB Position to Max (#max).
8. Execute steps 5 to 6.

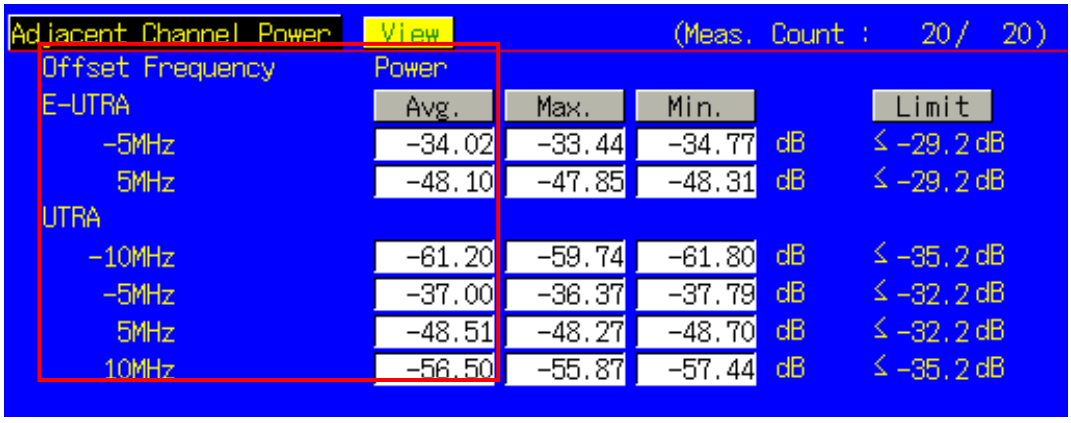
[(QPSK, FullRB) measurements]
9. Execute **TESTPRM TX_MAXPWR_Q_F** to set Test Parameter to TX1 - Max. Power (QPSK/FullRB).
10. Execute steps 5 to 6.

[(16QAM, PartialRB) measurements]
11. Execute **TESTPRM TX_MAXPWR_16_P** to set Test Parameter toTX1 - Max. Power (16QAM/PartialRB)).
12. Execute steps 4 to 8.

[(16QAM, FullRB) measurements]
15. **TESTPRM TX_MAXPWR_16_F** to set Test Parameter to TX1 - Max. Power (16QAM/FullRB).
16. Execute steps 5 to 6.

***NOTE 1: The PartialRB allocation UL RB Position is divided as follows:***

***When Test Frequency is Low range, Max (#max)***
***When Test Frequency is Mid range, Min (#0) and Max (#max)***
***When Test Frequency is High range, Min (#0)***




**Example of measurement result when Test Parameter is TX1 - Max. Power (QPSK/PartialRB).**

## 1.3.27. 6.2.4 Additional Maximum Power Reduction (A-MPR)

### 6.6.2.2 Additional Spectrum Emission Mask

Because there are no test parameters supporting Additional Maximum Power Reduction tests and Additional Spectrum Emission Mask tests, select the basic parameter (TX1 – Max. Power (QPSK/FullRB)) and set parameters and standard values required for the test individually.

The following shows an example for 20 measurements when the UL Modulation and RB are (QPSK, PartialRB), (QPSK, FullRB), (16QAM, PartialRB) and (16QAM, FullRB) when additionalSpectrumEmission is NS_03, Operating Band is 2, Test Frequency is Mid range, and Test Channel Bandwidth is 5 MHz.

[Common Setting]

1. Execute **BAND 2** to set Operating Band to 2.
2. Execute **PWR_AVG 20** to set the average count of power measurement to 20 times.
3. Execute **SEM_AVG 20** to set the average count of Spectrum Emission Mask to 20 times.
4. Connect to Test Mode (→1.3.3).
5. Execute **TESTPRM TX_MAXPWR_Q_F** to set Test parameter to TX1 – Max. Power (QPSK/FullRB).
6. Execute **ALLMEASITEMS_OFF** to set fundamental measurement items to OFF at one time.
7. Execute **PWR_MEAS ON** to set Power measurement to ON.
8. Execute **SEM_MEAS ON** to set Spectrum Emission Mask measurement to ON.
9. Execute **SIB2_NS NS_03** to set additionalSpectrumEmission to NS_03.
   (Check that the broadcasting information change reflected to UE →1.3.5.)

[For (QPSK, PartialRB) measurement]

10. Execute **ULRMC_MOD QPSK** to set UL RMC modulation to QPSK.
11. Execute **ULRMC_RB 8** to set UL RB number to 8.
12. Execute **ULRB_POS MIN** to set UL RB Position to Min (#0).
13. Execute **TP_MPR1_UL 25.7** to set TX Power measurement Pass/Fail upper limit value to 25.7 dBm.
14. Execute **TP_MPR1_LL 19.3** to set TX Power measurement Pass/Fail lower limit value 19.3 dBm.
15. Execute **SWP** to perform Power measurement.
16. Execute **POWER? AVG** to read Tx Power measurement result.
17. Execute **POWERPASS?** to check the measurement result is PASS.
18. Execute **SEMPASS?** to check SEM result is PASS.
19. Execute **ULRB_POS MAX** to set UL RB Position to Max (#max).
20. Execute step 15 to 18.
21. Execute **ULRMC_RB 6** to set UL RB number to 6.
22. Execute **ULRB_POS MIN** to set UL RB Position to Min (#0).
23. Execute **TP_MPR1_UL 25.7** to set TX Power measurement Pass/Fail upper limit value to 25.7 dBm.
24. Execute **TP_MPR1_LL 20.3** to set TX Power measurement Pass/Fail lower limit value 20.3 dBm.
25. Execute step 15 to 18.
26. Execute **ULRB_POS MAX** to set UL RB Position to Max (#max).
27. Execute steps 15 to 18.

[For (QPSK, FullRB) measurement]

28. Execute **ULRMC_RB 25** to set UL RB number to 25.
29. Execute **TP_MPR1_UL 25.7** to set TX Power measurement Pass/Fail upper limit value to 25.7 dBm.
30. Execute **TP_MPR1_LL 18.33** to set TX Power measurement Pass/Fail lower limit value to 18.3 dBm.
31. Execute steps 15 to 18.

[For (16QAM, PartialRB) measurement]

32. Execute **ULRMC_MOD 16QAM** to set UL RMC modulation method to 16QAM.
33. Execute **ULRMC_RB 8** to set UL RB number to 8.
34. Execute **ULRB_POS MIN** to set UL RB Position to Min (#0).
35. Execute **TP_MPR1_UL 25.7** to set TX Power measurement Pass/Fail upper limit value to 25.7 dBm.
36. Execute **TP_MPR1_LL 18.3** to set TX Power measurement Pass/Fail lower limit value to 18.3 dBm.
37. Execute step 15 to 18.
38. Execute **ULRB_POS MAX** to set UL RB Position to Max (#max).
39. Execute steps 15 to 18.

[For (16QAM, FullRB) measurement]

40. Execute **ULRMC_RB 25** to set UL RB number to 25.
41. Execute **TP_MPR1_UL 25.7** to set TX Power measurement Pass/Fail upper limit value to 25.7 dBm.
42. Execute **TP_MPR1_LL 16.8** to set TX Power measurement Pass/Fail lower limit value to 16.8 dBm.
43. Execute steps 15 to 18.

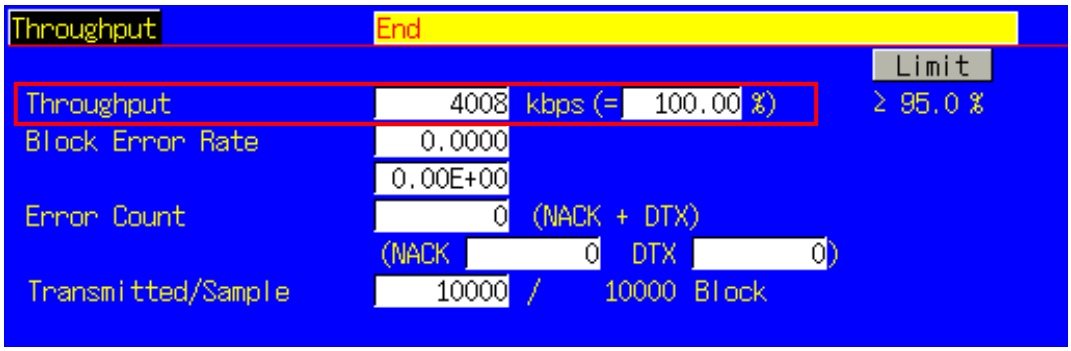
***NOTE 1: The UL RB Position for PartialRB allocation is divided as follows:***

***Max (#max) when Test Frequencies is Low range***
***Min (#0) and Max (#max) when Test Frequencies is Mid range***
***Min (#0) when Test Frequencies is High range***

***NOTE 2: There is no need to set separately because the Pass/Fail evaluation value for Spectrum Emission Mask measurement changes in accordance with the additionalSpectrumEmission setting.***

### 1.3.28. 7.3 Reference Sensitivity Level

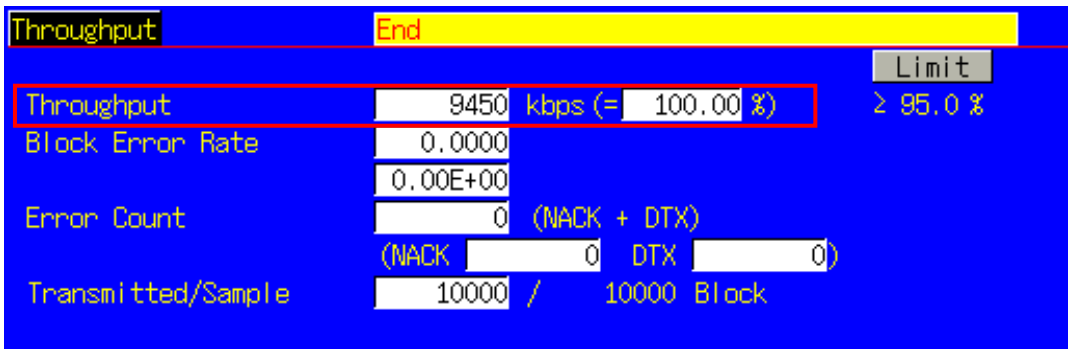
1. Connect to Test Mode (→1.3.3).
2. Execute **TESTPRM RX_SENS** to set Test Parameter to RX – Ref. Sens./Freq. Error.
3. Execute **TPUT_SAMPLE 10000** to set the number of Throughput measurement samples to 10000.
4. Execute **SWP** to perform Throughput measurement.
5. Execute **TPUT? PER** to read the Throughput measurement result (%).
6. Execute **TPUTPASS?** to check that the Throughput measurement Pass/Fail judgment is Pass.




**Example of measurement result when Test Parameter is RX – Ref. Sens./Freq. Error.**

### 1.3.29. 7.4 Maximum Input Level

1. Connect to Test Mode (→1.3.3).
2. Execute **TESTPRM RX_MAX** to set Test Parameter to RX - Max. Input Level.
3. Execute **TPUT_SAMPLE 10000** to set the number of Throughput measurement samples to 10000.
4. Execute **SWP** to perform Throughput measurement.
5. Execute **TPUT? PER** to read the Throughput measurement result (%).
6. Execute **TPUTPASS?** to check that the Throughput measurement Pass/Fail judgment is Pass.
7. 




**Example of measurement result when Test Parameter is RX - Max. Input Level.**

### 1.3.30. 7.9 Spurious emissions

Performs Rx spurious emission tests using external spectrum analyzer.

1. Connect the MT8820C, external spectrum analyzer and UE.
2. Execute **CALLDROP OFF** to set Call Drop function to OFF.
3. Connect to Test Mode (→1.3.3).
4. Execute **ULRMC_RB 0** to set UL RB number to 0.
5. Execute **DLRMC_RB 0** to set DL RB number to 0.
6. Measure Rx spurious emission using an external spectrum analyzer.
7. Check that maximum level in each frequency bandwidth is lower than standardized value.

***NOTE 1: Refer to 3GPP TS36.508 Annex A, Figure A.8 for the connection between the MT8820C, external spectrum analyzer and UE.***

## 1.3.31. Test Parameters Supporting 3GPP Test Items

Chart 1.3-1 shows the relationship between 3GPP TS36.521-1 defined test items and test parameters. Set test parameters matching each test item to test.
No. in Chart 1.3-1 corresponds to No. in Chart 1.3-2.

**Chart 1.3-1: 3GPP Test Item and Test Parameter (1/2)**

| Test Item of 3GPP | No. | Test Parameter |
|---|---|---|
| 6.2.2 UE Maximum Output Power | 4 | TX1 - Max. Power (QPSK/1RB) |
| | 5 | TX1 - Max. Power (QPSK/PartialRB) |
| 6.2.3 Maximum Power Reduction (MPR) | 6 | TX1 - Max. Power (QPSK/FullRB) |
| | 7 | TX1 - Max. Power (16QAM/PartialRB) |
| | 8 | TX1 - Max. Power (16QAM/FullRB) |
| 6.2.5 Configured UE Transmitted Output Power | 17 | TX2 - Configured Power (Test Point 1) |
| | 18 | TX2 - Configured Power (Test Point 2) |
| | 19 | TX2 - Configured Power (Test Point 3) |
| 6.3.2 Minimum Output Power | 9 | TX1 - Min. Power |
| 6.3.4.1 General ON/OFF Time Mask | 16 | TX2 - General Time Mask |
| 6.3.4.2 PRACH and SRS Time Mask | 1 | Idle/Call - PRACH Time Mask |
| 6.3.5.1 Power Control Absolute Power Tolerance | 24 | TX3 - Absolute Power (Test Point1) |
| | 25 | TX3 - Absolute Power (Test Point2) |
| 6.3.5.2 Power Control Relative Power Tolerance | 32 | TX3 - Relative Power (Ramping Up A) |
| | 33 | TX3 - Relative Power (Ramping Up B) |
| | 34 | TX3 - Relative Power (Ramping Up C) |
| | 35 | TX3 - Relative Power (Ramping Down A) |
| | 36 | TX3 - Relative Power (Ramping Down B) |
| | 37 | TX3 - Relative Power (Ramping Down C) |
| | 38 | TX3 - Relative Power (Alternating) |
| 6.3.5.3 Aggregate Power Control Tolerance | 39 | TX3 - Aggregate Power (PUSCH Sub-test) |
| | 40 | TX3 - Aggregate Power(PUCCH Sub-test) |
| 6.5.1 Frequency Error | 43 | RX – Ref. Sens/Freq.Error |
| 6.5.2.1 Error Vector Magnitude (EVM) - PUSCH | 5 | TX1 - Max. Power (QPSK/PartialRB) |
| | 6 | TX1 - Max. Power (QPSK/FullRB) |
| | 7 | TX1 - Max. Power (16QAM/PartialRB) |
| | 8 | TX1 - Max. Power (16QAM/FullRB) |
| | 12 | TX1 - EVM/IBE/LEAK @ -40 dBm (QPSK/PartialRB) |
| | 13 | TX1 - EVM @ -40dBm (QPSK/Full RB) |
| | 14 | TX1 - EVM @ -40dBm (16QAM/Partial RB) |
| | 15 | TX1 - EVM @ -40dBm (16QAM/Full RB) |
| 6.5.2.1 Error Vector Magnitude (EVM) - PUCCH | 20 | TX2 - PUCCH EVM @ Max. |
| | 23 | TX2 - PUCCH EVM/IBE @ -40 dBm |
| 6.5.2.1 Error Vector Magnitude (EVM) - PRACH | 2 | Idle/Call - PRACH EVM (Test Point1) |
| | 3 | Idle/Call - PRACH EVM (Test Point2) |
| 6.5.2.1A PUSCH-EVM with exclusion period | 41 | TX3 - EVM with Exclusion Period (QPSK) |
| | 42 | TX3 - EVM with Exclusion Period (16QAM) |
| 6.5.2.2 Carrier Leakage | 10 | TX1 - IBE/LEAK @ 0 dBm |
| | 11 | TX1 - IBE/LEAK @ -30 dBm |
| | 12 | TX1 - EVM/IBE/LEAK @ -40 dBm (QPSK/PartialRB) |

**Chart 1.3-1: 3GPP Test Item Test Parameter (2/2)**

| Test Item of 3GPP | | No. | Test Parameter |
|---|---|---|---|
| 6.5.2.3 In-band Emissions for Non Allocated RB - PUSCH | General | 10 | TX1 - IBE/LEAK @ 0 dBm |
| | | 11 | TX1 - IBE/LEAK @ -30 dBm |
| | | 12 | TX1 - EVM/IBE/LEAK @ -40 dBm (QPSK/PartialRB) |
| | IQ Image | 10 | TX1 - IBE/LEAK @ 0 dBm |
| | | 11 | TX1 - IBE/LEAK @ -30 dBm |
| | | 12 | TX1 - EVM/IBE/LEAK @ -40 dBm (QPSK/PartialRB) |
| | Carrier Leakage | 10 | TX1 - IBE/LEAK @ 0 dBm |
| | | 11 | TX1 - IBE/LEAK @ -30 dBm |
| | | 12 | TX1 - EVM/IBE/LEAK @ -40 dBm (QPSK/PartialRB) |
| 6.5.2.3 In-band Emissions for Non Allocated RB - PUCCH | General | 21 | TX2 - PUCCH IBE @ 0 dBm |
| | | 22 | TX2 - PUCCH IBE @ -30 dBm |
| | | 23 | TX2 - PUCCH EVM/IBE @ -40 dBm |
| | IQ Image | 21 | TX2 - PUCCH IBE @ 0 dBm |
| | | 22 | TX2 - PUCCH IBE @ -30 dBm |
| | | 23 | TX2 - PUCCH EVM/IBE @ -40 dBm |
| | Carrier Leakage | 21 | TX2 - PUCCH IBE @ 0 dBm |
| | | 22 | TX2 - PUCCH IBE @ -30 dBm |
| | | 23 | TX2 - PUCCH EVM/IBE @ -40 dBm |
| 6.5.2.4 EVM Equalizer Spectrum Flatness | | 6 | TX1 - Max. Power (QPSK/FullRB) |
| 6.6.1 Occupied Bandwidth | | 6 | TX1 - Max. Power (QPSK/FullRB) |
| 6.6.2.1 Spectrum Emission Mask | | 5 | TX1 - Max. Power (QPSK/PartialRB) |
| | | 6 | TX1 - Max. Power (QPSK/FullRB) |
| | | 7 | TX1 - Max. Power (16QAM/PartialRB) |
| | | 8 | TX1 - Max. Power (16QAM/FullRB) |
| 6.6.2.3 Adjacent Channel Leakage Power Ratio | | 5 | TX1 - Max. Power (QPSK/PartialRB) |
| | | 6 | TX1 - Max. Power (QPSK/FullRB) |
| | | 7 | TX1 - Max. Power (16QAM/PartialRB) |
| | | 8 | TX1 - Max. Power (16QAM/FullRB) |
| 7.3 Reference Sensitivity Level | | 43 | RX – Ref. Sens./Freq.Error |
| 7.4 Maximum Input Level | | 44 | RX - Max. Input Level |

## 1.3.32. Remote Commands List Limiting Pass/Fail Judgment

Remote commands limiting Pass/Fail judgment when selecting Test Parameter are shown in Chart 1.3-2.
No. in Chart 1.3-1 corresponds to No. in Chart 1.3-2.

**Chart 1.3-2: Remote Commands List Limiting Pass/Fail Judgment (1/3)**

| 3GPP Test Item | No. | Channel Bandwidth (MHz) | Remote Command |
|---|---|---|---|
| 6.2.2 UE Maximum Output Power | 4, 5 | ----- | TP_MAXPWR_LL<br>TP_MAXPWR_UL |
| 6.2.3 Maximum Power Reduction (MPR) | 6 | ----- | TP_MPR1_LL<br>TP_MPR1_UL |
| | 7 | | TP_MPR2_LL<br>TP_MPR2_UL |
| | 8 | | TP_MPR3_LL<br>TP_MPR3_UL |
| 6.2.5 Configured UE Transmitted Output Power | 17 | ----- | TP_CONFPWR1_TOL |
| | 18 | | TP_CONFPWR2_TOL |
| | 19 | | TP_CONFPWR3_TOL |
| 6.3.2 Minimum Output Power | 9 | ----- | TP_MINPWR_UL |
| 6.3.4.1 General ON/OFF Time Mask | 16 | ----- | TP_TMASK_GEN_TOL<br>TP_OFFPWR_UL |
| 6.3.4.2 PRACH and SRS Time Mask | 1 | ----- | TP_TMASK_PRACH_TOL<br>TP_OFFPWR_UL |
| 6.3.5.1 Power Control Absolute Power Tolerance | 24, 25 | ----- | TP_PCTABS_TOL |
| 6.3.5.2 Power Control Relative Power Tolerance | 32 | ----- | TP_PCTREL_RMP_TOL<br>TP_PCTREL_RMP_CNG_TOL1<br>TP_PCTREL_RMP_CNG_TOL2<br>TP_PCTREL_RMP_CNG_TOL3<br>TP_PCTREL_RMP_E |
| | 33 | | |
| | 34 | | |
| | 35 | | |
| | 36 | | |
| | 37 | | |
| | 38 | | TP_PCTREL_ALT_TOL |
| 6.3.5.3 Aggregate Power Control Tolerance | 39 | ----- | TP_PCTAGG_PUSCH_TOL |
| | 40 | | TP_PCTAGG_PUCCH_TOL |
| 6.5.1 Frequency Error | 43 | ----- | TP_FERR_PPM<br>TP_FERR_HZ |
| 6.5.2.1 Error Vector Magnitude (EVM) - PUSCH | 5, 6, 12, 13 41 | ----- | TP_EVM_QPSK<br>TP_RSEVM_QPSK |
| 6.5.2.1A PUSCH-EVM with exclusion period | 7, 8, 14, 15 42 | | TP_EVM_16QAM<br>TP_RSEVM_16QAM |
| 6.5.2.1 Error Vector Magnitude (EVM) - PUCCH | 20, 23 | ----- | TP_EVM_PUCCH |
| 6.5.2.1 Error Vector Magnitude (EVM) - PRACH | 2, 3 | ----- | TP_EVM_PRACH |
| 6.5.2.2 Carrier Leakage | 10 | ----- | TP_CARRLEAK_0DBM |
| | 11 | | TP_CARRLEAK_M30DBM |

| | | | |
|---|---|---|---|
| | 12 | | TP_CARRLEAK_M40DBM |

**Chart 1.3-2: Remote Commands List Limiting Pass/Fail Judgment (2/3)**

| 3GPP Test Item | | No. | Channel Bandwidth (MHz) | Remote Command |
|---|---|---|---|---|
| 6.5.2.3 In-band Emissions for Non Allocated RB - PUSCH / PUCCH | General | 10, 11, 12, 21, 22, 23 | ----- | TP_INBANDE_GEN_A<br>TP_INBANDE_GEN_B<br>TP_INBANDE_GEN_C<br>TP_INBANDE_GEN_D |
| | IQ Image | | | TP_INBANDE_IMG |
| | Carrier Leakage | 10, 21 | | TP_INBANDE_LEAK_0DBM |
| | | 11, 22 | | TP_INBANDE_LEAK_M30DBM |
| | | 12, 23 | | TP_INBANDE_LEAK_M40DBM |
| 6.5.2.4 EVM Equalizer Spectrum Flatness | | 6 | ----- | TP_SPECFLAT1_PP<br>TP_SPECFLAT1_RD<br>TP_SPECFLAT2_PP<br>TP_SPECFLAT2_RD |
| 6.6.1 Occupied Bandwidth | | 6 | 1.4 | TP_OBW_1.4MHZ |
| | | | 3 | TP_OBW_3MHZ |
| | | | 5 | TP_OBW_5MHZ |
| | | | 10 | TP_OBW_10MHZ |
| | | | 15 | TP_OBW_15MHZ |
| | | | 20 | TP_OBW_20MHZ |
| 6.6.2.1 Spectrum Emission Mask | | 5, 6, 7, 8 | 1.4 | TP_SEM1.4MHZ_1<br>TP_SEM1.4MHZ_2<br>TP_SEM1.4MHZ_3<br>TP_SEM1.4MHZ_4 |
| | | | 3 | TP_SEM3MHZ_1<br>TP_SEM3MHZ_2<br>TP_SEM3MHZ_3<br>TP_SEM3MHZ_4 |
| | | | 5 | TP_SEM5MHZ_1<br>TP_SEM5MHZ_2<br>TP_SEM5MHZ_3<br>TP_SEM5MHZ_4 |
| | | | 10 | TP_SEM10MHZ_1<br>TP_SEM10MHZ_2<br>TP_SEM10MHZ_3<br>TP_SEM10MHZ_4 |
| | | | 15 | TP_SEM15MHZ_1<br>TP_SEM15MHZ_2<br>TP_SEM15MHZ_3<br>TP_SEM15MHZ_4 |
| | | | 20 | TP_SEM20MHZ_1<br>TP_SEM20MHZ_2<br>TP_SEM20MHZ_3<br>TP_SEM20MHZ_4 |

**Chart 1.3-2: Remote Commands List Limiting Pass/Fail Judgment (3/3)**

| 3GPP Test Item | No. | Channel Bandwidth (MHz) | Remote Command |
|---|---|---|---|
| 6.6.2.3 Adjacent Channel Leakage Power Ratio | 5, 6, 7, 8 | ----- | TP_ACLR_E<br>TP_ACLR_U1<br>TP_ACLR_U2<br>TP_ACLR_LL |
| 7.3 Reference Sensitivity Level | 43 | ----- | TP_REFSENS |
| 7.4 Maximum Input Level | 44 | ----- | TP_MAXINPT |

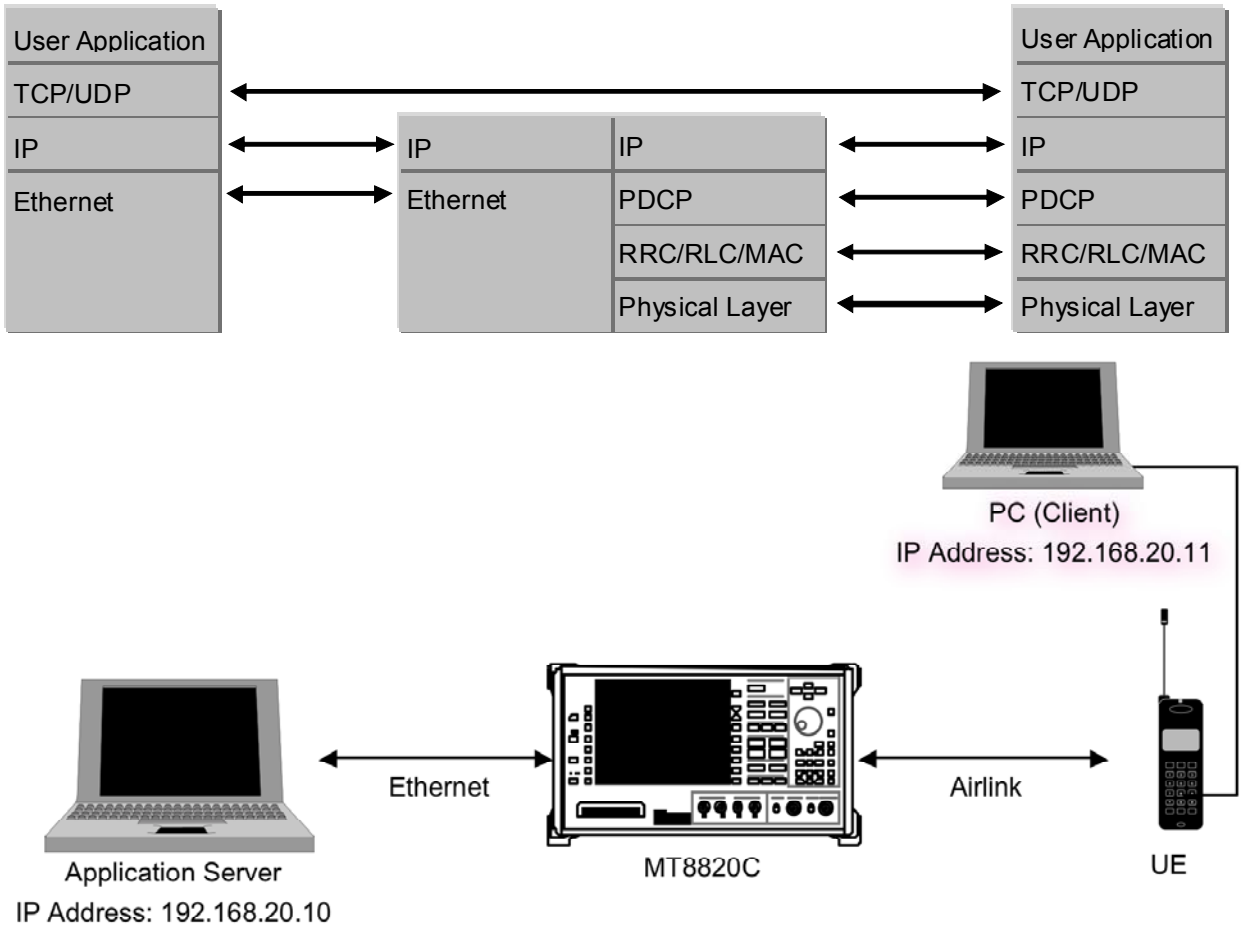
## 1.4. UE Report

Reports UE information.

1. Connect to Test Mode (→1.3.3).
2. Execute **MEASREP ON** to report UE information.
3. Execute **CALLRFR** to initialize UE Report value.
4. Execute **RSRP? FLAG**. When the response is 1, RSRP is returned from the UE.
5. Execute **RSRP?** to read the RSRP value.
6. Return to step 3 to read the Report value again.

## 1.5. IP Data Transfer Test

The IP data transfer between an application server connected to the MT8820C and a UE (mobile terminal) can be tested by installing the MX882012C-006/ MX882013C-006 IP Data Transfer option in the MT8820C. Furthermore, adding the MX882012C-011/ MX882013C-011 FDD 2x2 MIMO DL option supports the Downlink 2x2MIMO IP Data Transfer Test. The operation manual describes test procedures from section 1.5.3 and later; refer to the manual for details and GPIB commands.




**IP Data Transfer Test Setup Example**

<Preparation>

- LTE mobile terminal supporting IP connection
- RF cable to connect MT8820C and LTE mobile terminal
- Application server PC with LAN adapter supporting 1000Base-TX
- Client PC
- Cross cable to connect MT8820C and application server
- UDP/TCP Throughput measurement software (installed in application server and client PCs)*1

*1: This test uses the open-source software Iperf to measure throughput. It can be downloaded from the Internet. After downloading, copy the execute file (Iperf.exe) to the root of the C: drives in the application server and client PCs.

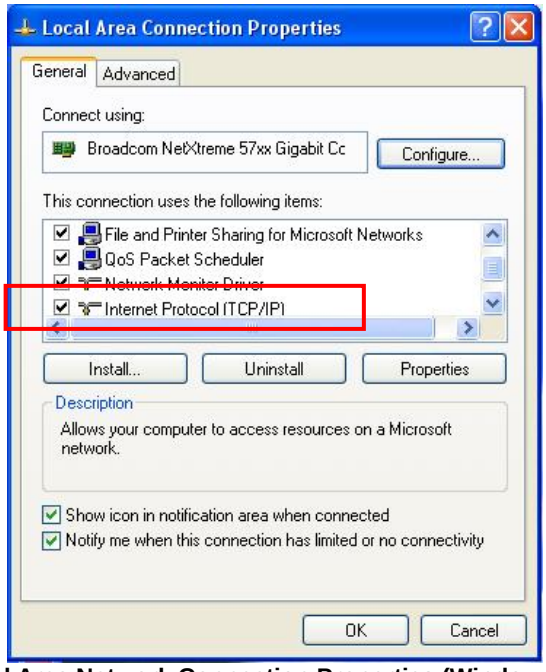
### 1.5.1. Setting MT8820C and Application Server

Connect the application server PC and MT8820C and set the IP address of the application server.

1. With the MT8820C power OFF, use a crossover Ethernet cable to connect the 1000Base-TX/100Base-TX/10Base-T port on the back panel of the MT8820C to the application server.

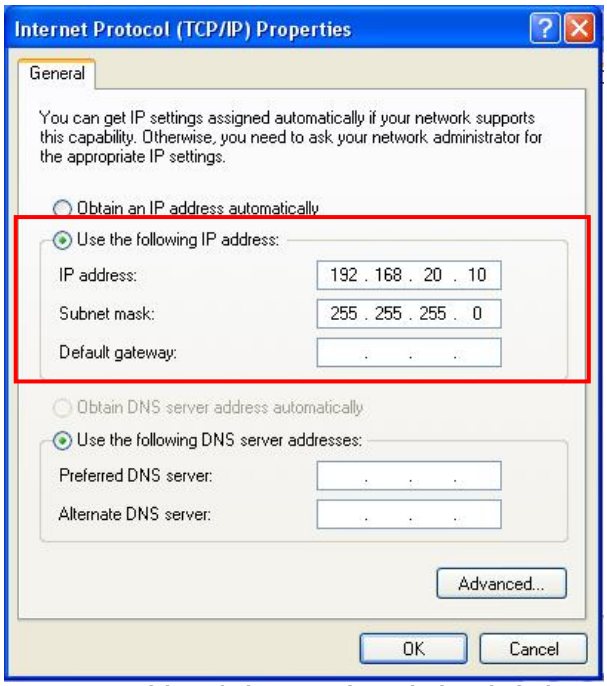
**1000Base-TX/100Base-TX/10Base-T Port**

2. Open the Local Area Connection Properties window at the application server PC and put a checkmark in the Internet Protocol (TCP/IP) checkbox.



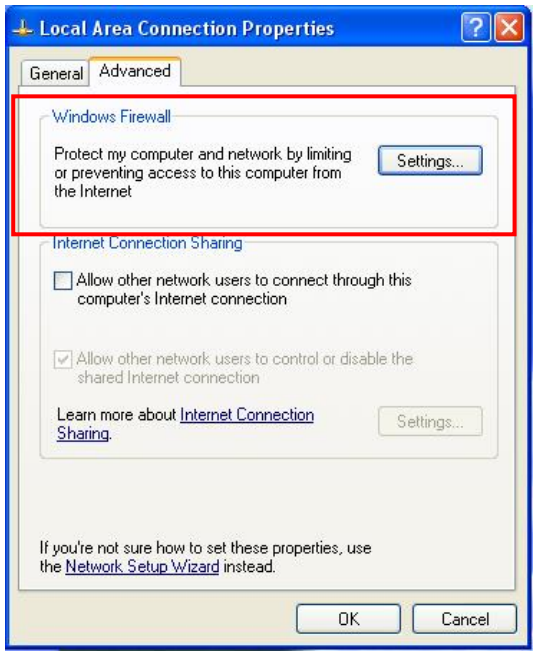

**Local Area Network Connection Properties (Windows XP)**

3. Double-click Internet Protocol (TCP/IP) to open the Internet Protocol (TCP/IP) Properties window.




**Internet Protocol (TCP/IP) Properties Window (Windows XP)**

4. Choose [Use the following IP address] and set [IP address] and [Subnet mask] as follows:
   IP address: 192.168.20.10
   Subnet mask: 255.255.255.0
5. Click [OK] to close the Internet Protocol (TCP/IP) Properties window
6. Select the [Advanced] tab at the Local Area Connection Properties window and disable the Windows firewall.




**Advanced Tab of Local Area Network Connection Properties Window (Windows XP)**

7. Click [OK] to close the window.
8. Start the MT8820C.
9. Select and load the LTE measurement software to Phone1.
10. After loading, start the LTE measurement software on Phone1.
11. When testing in a 2x2MIMO environment, select and load the LTE measurement software on to Phone2 as well.
12. After loading, start the LTE measurement software on Phone2.

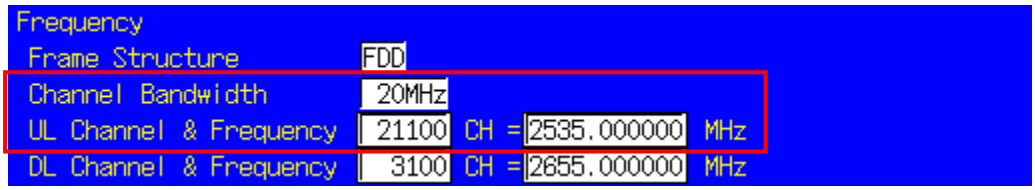
### 1.5.2. Setting Client PC

The client PC connection and setting depend on the mobile terminal. Set according to the connection method used.

### 1.5.3. Initial Condition Setting

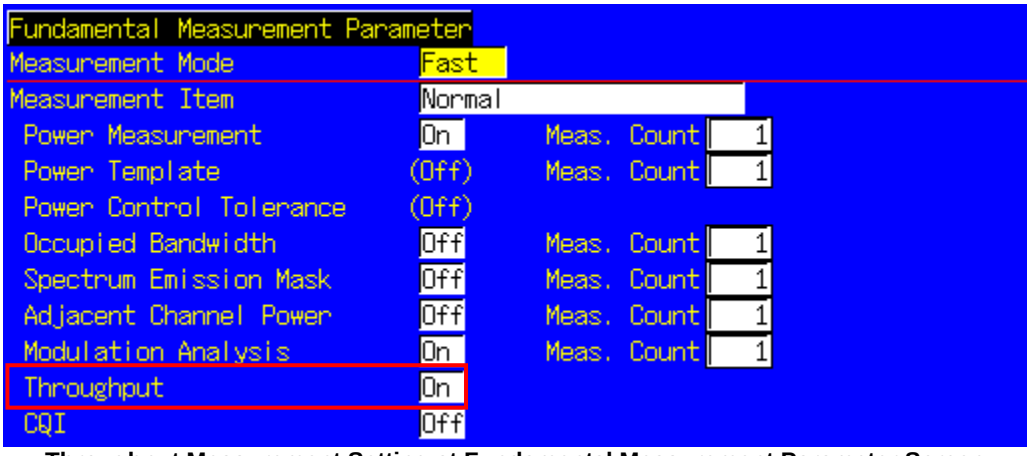
The following describes the settings for operating band 7, mid-range test frequency and 20-MHz test channel bandwidth.

1. Run [PRESET] to initialize the parameter settings.
2. Set [Uplink Channel] to 21100.
3. Set [Channel Bandwidth] to 20 MHz.




**UL Channel/Channel Bandwidth setting at Common Parameter Setting Screen**

4. Set [Throughput] at the Fundamental Measurement Parameter screen to On.

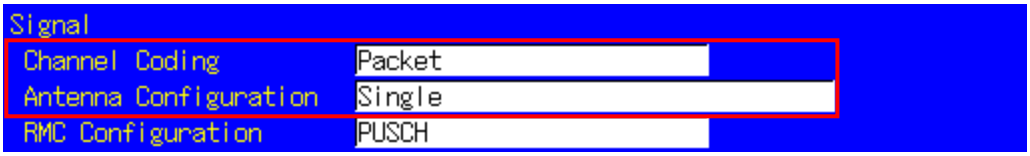



**Throughput Measurement Setting at Fundamental Measurement Parameter Screen**

### 1.5.4. Position Registration and Packet Connection (single antenna)

Perform UE position registration and packet connection.

1. Connect the mobile terminal to the MT8820C.
2. Set [Channel Coding] to Packet.
3. Set [Antenna Configuration] to Single.

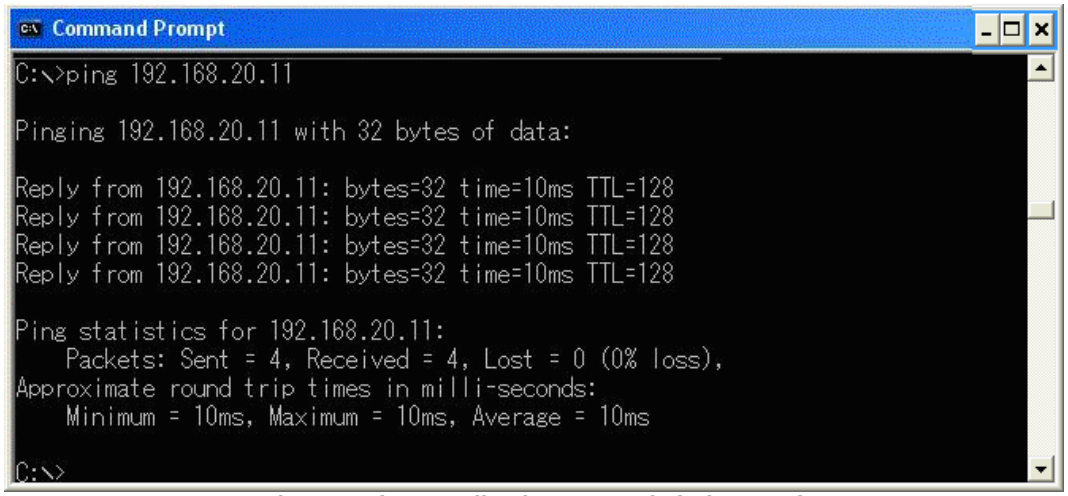



**Channel Coding/Antenna Configuration Setting at Common Parameter Screen**

4. Set [Client IP Address] to 192.168.20.11.

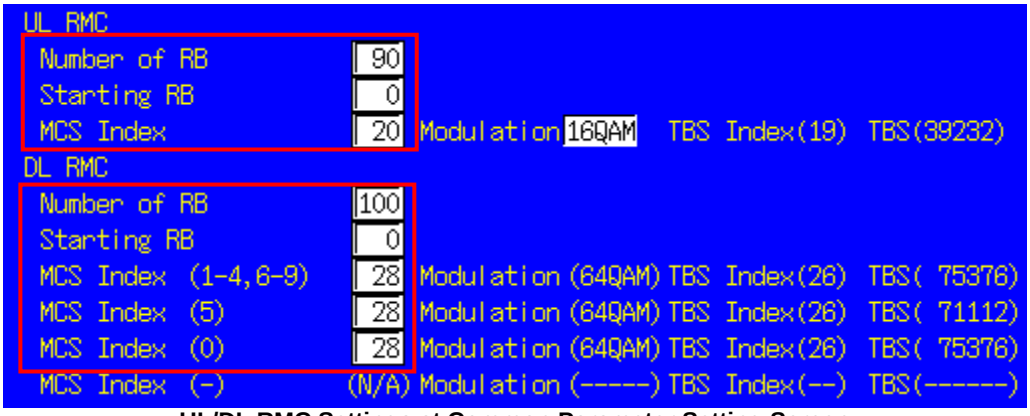

**Client IP Address setting on the Call Processing Parameter setting display**

5. Switch on the mobile terminal.
6. Wait for packet communication from the mobile terminal to be established.
   The MT8802C Call Processing status changes from Idle→Registration→Connected. When the status is Connected, communication is enabled between the application server and client PCs.
7. Press [Single] to set Input level near to the Tx power measurement result.
   If the mobile terminal supports Power Control by the TPC, this step can be omitted.
8. Run the Ping command from the Command Prompt window of the client or application server to confirm the IP connection. The following figure shows the result for the application server.



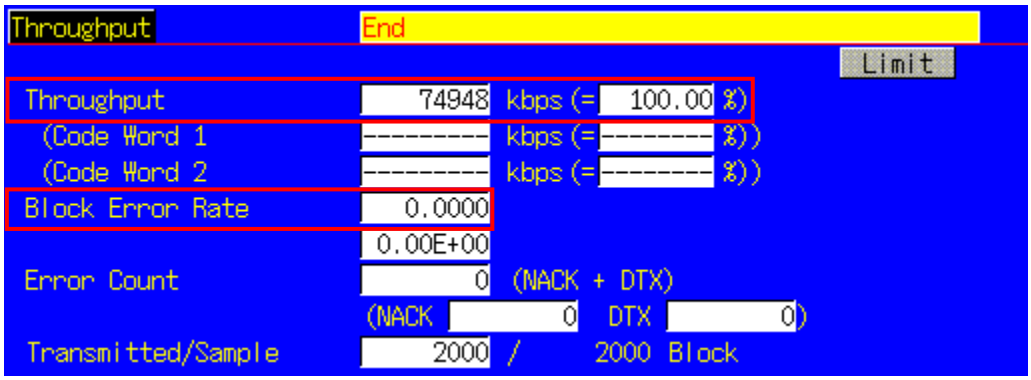

**Ping Result at Application Server (Windows XP)**

9. Change [Starting RB], [Number of RB], and [MCS Index] at UL RMC and DL RMC of the Common Parameter Setting screen to change the Transport Block Size (TBS).




**UL/DL RMC Settings at Common Parameter Setting Screen**

10. Press [Single] to confirm that the MT8820C is receiving data from the mobile terminal at the Throughput and Block Error Rate fields of the Fundamental Measurement Parameter screen.
    If there is an error, change the RMC settings and repeat steps 9 and 10.



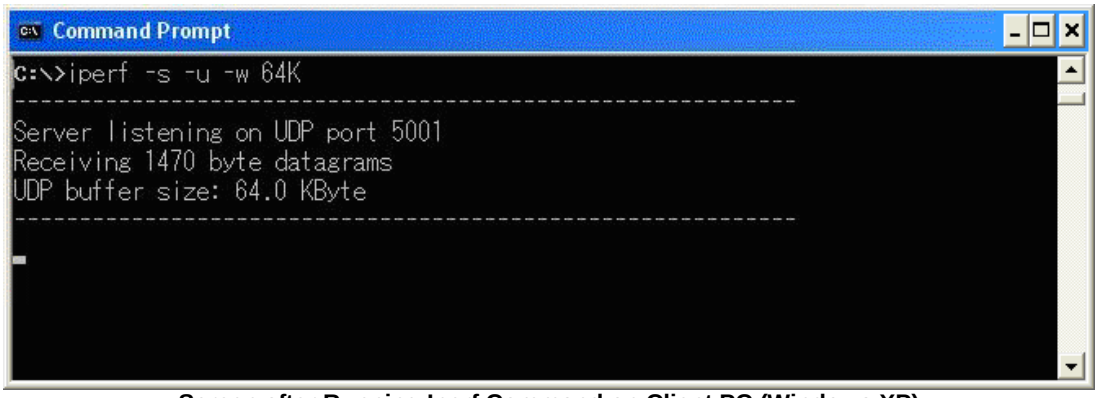

**Throughput Measurement Result at Fundamental Measurement Parameter Screen**

### 1.5.5. UDP Throughput Test for IP Data Transfer (single antenna)

This section explains UDP throughput measurements using Iperf for downlink throughput tests. Uplink throughput measurement is supported by switching the application server and client PCs.

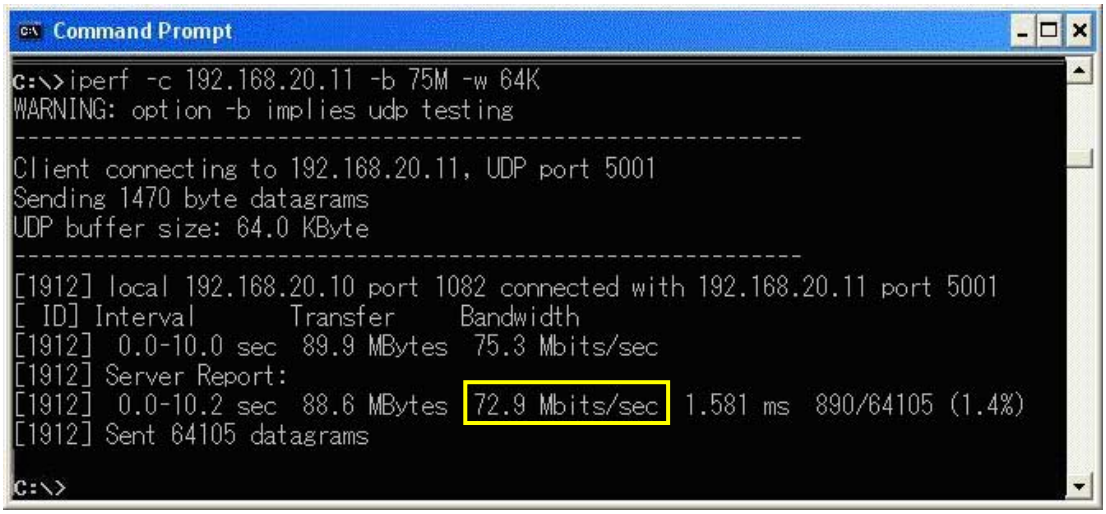
[Downlink throughput measurements]

1. Open the Command Prompt window on the client PC and run [cd c:¥] to change to the directory with Iperf.exe.
2. Run [iperf -s –u –u –w 64k] to put the client PC into the wait status.




**Screen after Running Iperf Command on Client PC (Windows XP)**

3. Open the Command Prompt window on the application server and run [cd c:¥] to change to the directory with Iperf.exe.
4. Run [iperf -c 192.168.20.11 -b 75M –w 64] to send UDP data from the application server.
   Although this command uses 75 M, refer to the Throughput measurement result for a rough idea of the value to use with this command.
5. The result (below) is displayed after about 10 seconds.




**Screen after Running Iperf Command on Application Server (Windows XP)**

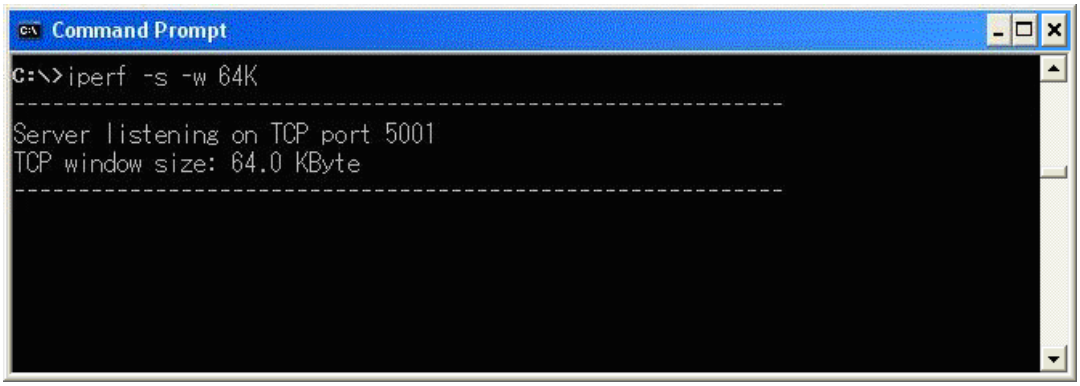
6. Close the Command Prompt windows at the application server and client PCs.

### 1.5.6. TCP Throughput Test for IP Data Transfer (single antenna)

This section explains TCP throughput measurement using the Iperf software for downlink throughput tests. Uplink throughput measurement is supported by switching the application server and client PCs.
Install Iperf at the root of the application server and client PC hard disks.

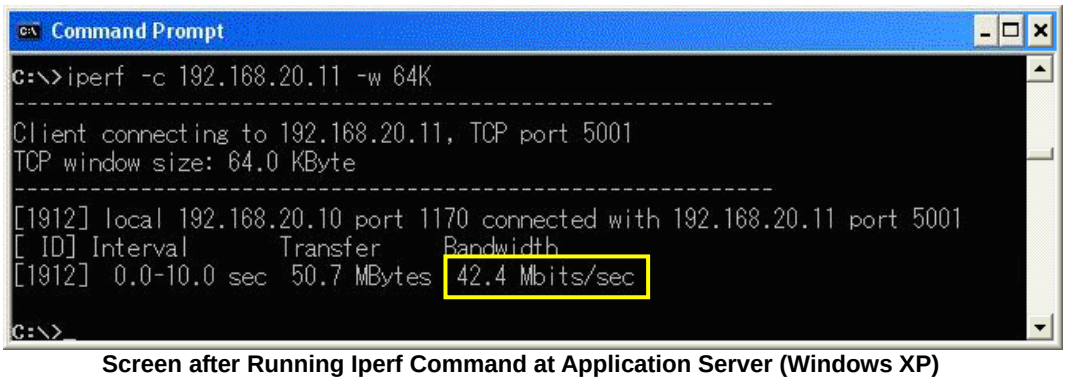
[Downlink throughput measurement]

1. Open the Command Prompt window on the client PC and run [cd c:¥] to change to the directory with Iperf.exe.
2. Run [iperf -s –w 64K] to put the client PC into the wait status.




**Screen after Running Iperf Command at Client PC (Windows XP)**

3. Open the Command Prompt window on the application server and run [cd c:¥] to change to the directory with Iperf.exe.
4. Run [iperf -c 192.168.20.11 -w 64K] to send TCP data from the application server.
5. The result is displayed in about 10 seconds.



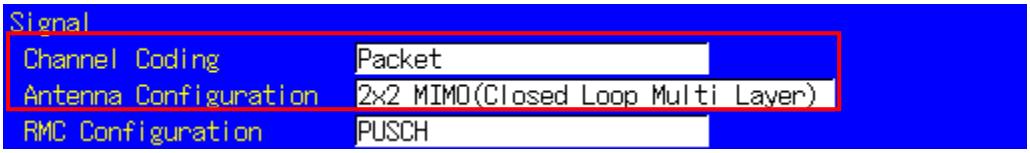

**Screen after Running Iperf Command at Application Server (Windows XP)**

6. Close the Command Prompt windows at the application server and client PCs.

### 1.5.7. Position Registration and Packet Connection (2×2MIMO)

Perform UE position registration and packet connection.

1. Connect the mobile terminal to the MT8820C.
2. Set [Channel Coding] to Packet.
3. Set [Antenna Configuration] to 2x2 MIMO (Closed Loop Multi Layer).

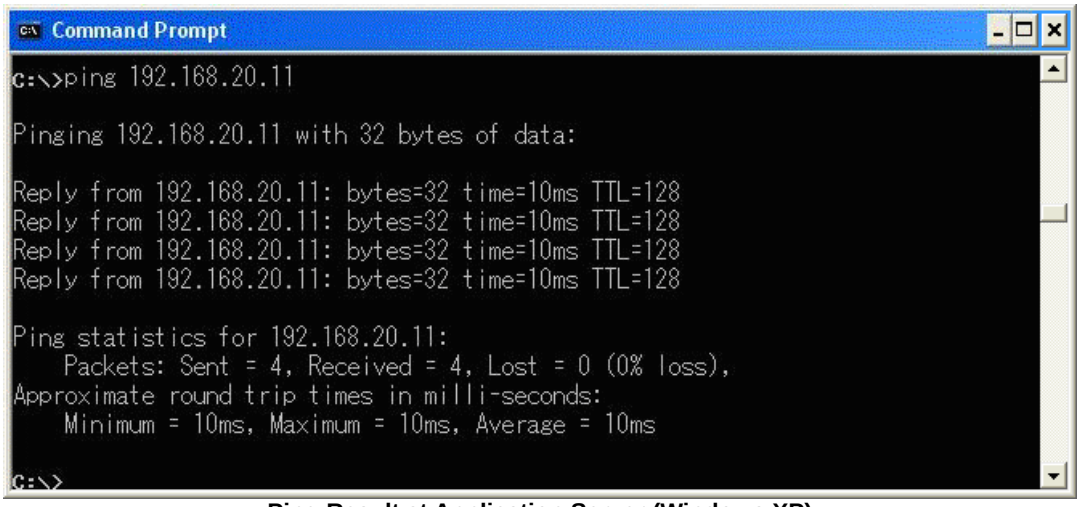



**Channel Coding/Antenna Configuration Setting at Common Parameter Setting Screen**

4. Set [Client IP Address] to 192.168.20.11.

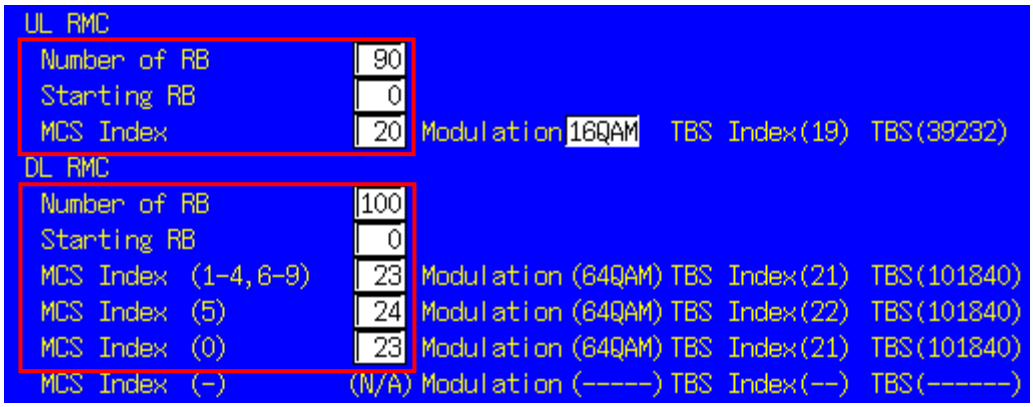

**Client IP Address Setting at Call Processing Parameter Setting Screen**

5. Switch on the mobile terminal.
6. Wait for packet communication from the mobile terminal to be established.
   The MT8802C Call Processing status changes from Idle→Registration→Connected. When the status is Connected, communication is enabled between the application server and client PCs.
7. Press [Single] to set the Input level near to the Tx power measurement result.
   If the mobile terminal supports Power Control by the TPC, this step can be omitted.
8. Run the Ping command from the Command Prompt window of the client or application server to confirm the IP connection. The following figure shows the result for the application server.



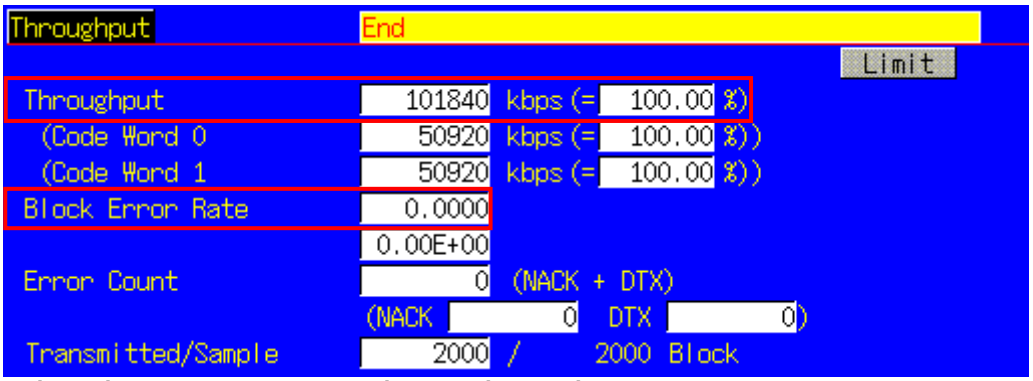

**Ping Result at Application Server (Windows XP)**

9. Change [Starting RB], [Number of RB], and [MCS Index] at UL RMC and DL RMC of the Common Parameter Setting screen to change the Transport Block Size (TBS)




**UL/DL RMC Settings at Common Parameter Setting Screen**

10. Press [Single] to confirm that the MT8820C is receiving data from the mobile terminal at the Throughput and Block Error Rate fields of the Fundamental Measurement Parameter screen.
    If there is an error, change the RMC settings and repeat steps 9 and 10



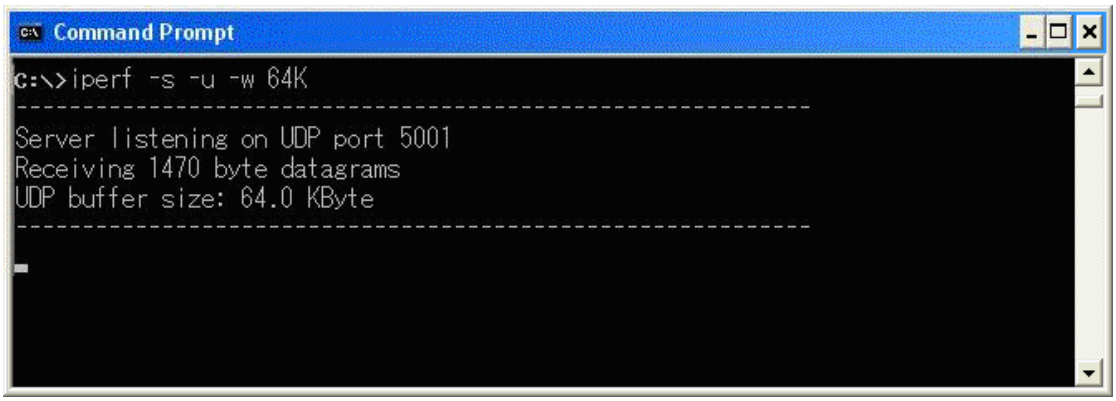

**Throughput Measurement Result at Fundamental Measurement Parameter Screen**

## 1.5.8. UDP Throughput Test for IP Data Transfer (2×2MIMO)

This section explains UDP throughput measurement using the Iperf software.

[Downlink throughput measurement]

1. Open the Command Prompt window on the client PC and run [cd c:¥] to change to the directory with Iperf.exe.
2. Run [iperf -s –u] to put the client PC into the wait status.

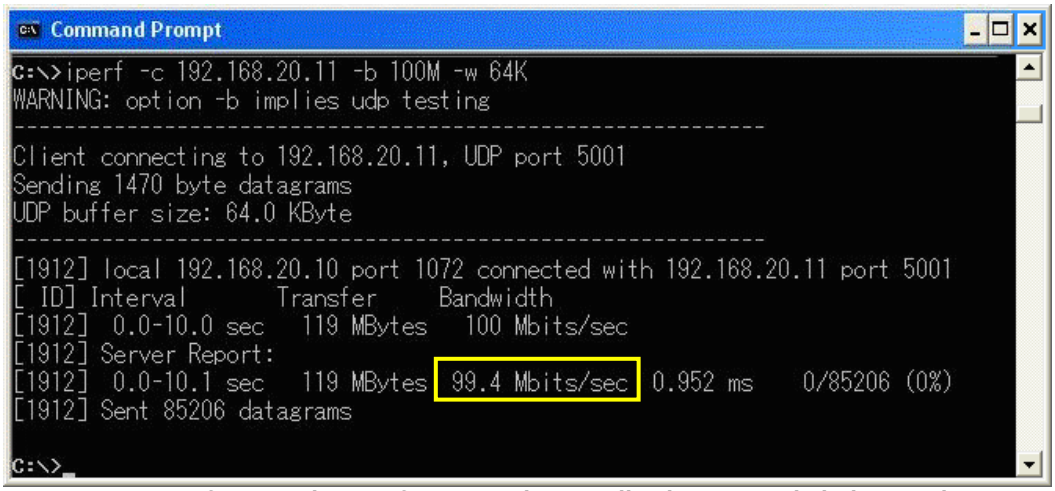



**Screen after Running Iperf Command on Client PC (Windows XP)**

3. Open the Command Prompt window on the server PC and run [cd c:¥] to change to the directory with Iperf.exe.
4. Run [iperf -c 192.168.20.11 -b 75M] to send UDP data from the application server.

Although this command uses 75 M, refer to the Throughput measurement result for a rough idea of the value to use with this command.

5. The result is displayed in about 10 seconds.




**Screen after Running Iperf Command on Application Server (Windows XP)**

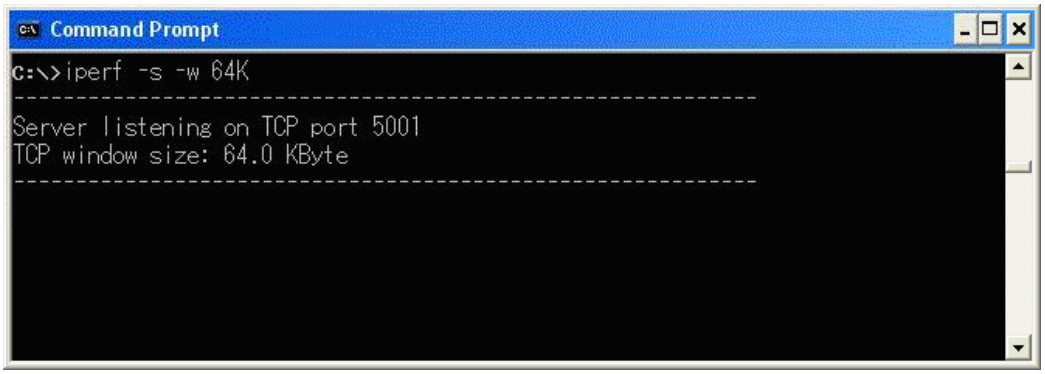
6. Close the Command Prompt windows at the application server and client PCs.

### 1.5.9. TCP Throughput Test for IP Data Transfer (2×2MIMO)

This section explains TCP throughput measurement using the Iperf software.

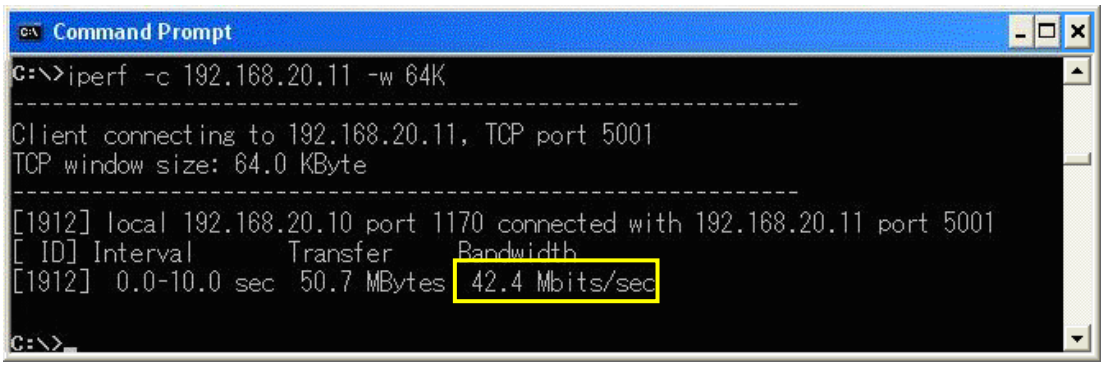
[Downlink throughput measurement]

1. Open the Command Prompt window on the client PC and run [cd c:¥] to change to the directory with Iperf.exe.
2. Run [iperf -s –w 64K] to put the client PC into the wait status.




**Screen after Running Iperf Command on Client PC (Windows XP)**

3. Open the Command Prompt window on the application server and run [cd c:¥] to change to the directory with Iperf.exe.
4. Run [iperf -c 192.168.20.11 -w 64K] to send TCP data from the application server.
5. The result is displayed in about 10 seconds.




**Screen after Running Iperf Command on Application Server (Windows XP)**

6. Close the Command Prompt windows at the application server and client PCs.

### 1.5.10. Disconnection

There are two packet disconnection methods.

1. Disconnect using the client PC or mobile terminal.
   The MT8820C Call Processing status changes from Connected→UE Release→Idle.
   If the status does not change to UE Release, press [End Call] at the MT8820C to disconnect.
2. When disconnecting using [End Call], the Call Processing status changes from Connected→NW Release→Idle.

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