Anritsu envision : ensure

UE Calibration Measurement

Radio Communication Analyzer MT8820B/MT8820C/MT8821C

Revision History

Ver. No	Date	Contents	Related product software version
1.00	July 2015	First edition created.	MX882000C Ver23.20/ MX882001C Ver23.03 MX882002C Ver23.10 MX882006C Ver23.10 MX882007C Ver23.01 MX882012C/13C/42C/43C Ver. 23.20, MX882100C/01C/02C/06C/07C/12C/13C/42C/43C Ver30.00

Contents

1. W-CDMA Measurement Software

1.1. Tx/Rx vs. Frequency Measurement

The Tx/Rx vs. Frequency Measurement is used to measure the average power of the UE for adjusting and confirming the Tx and Rx power.
This section describes an example of performing Tx/Rx vs. Frequency Measurement, where a step-shape signal output from the UE is measured to obtain the average power of each step.

■ Programming example for remote control

1. **SCRSEL FMEAS** /* Selects Fundamental Measurement screen. */
2. **CALLPROC OFF** /* Sets Call Processing to Off. */
3. **OLVL –80.0** /* Sets Output Level to –80.0 dBm. */
4. **ILVL 20.0** /* Sets Input Level to 20.0 dBm. */
5. **REGMTXREF OFF** /* Adjusts the input level of all segments to the Input Level setting. */
6. **LVLCONT ON** /* Sets Level Continuous to On. However, this is unnecessary for the MT8820C. */
7. **REGTX_RX_FREQ 2110,1920,2170,1980**
   /* Sets output frequency of sequence 0, input frequency of sequence 1, output frequency of sequence 1 and input frequency of sequence 2 to 2110 MHz, 1920 MHz, 2170 MHz and 1980 MHz. */
8. **REGMRXPWR –80,-85,-85,-90,-90**
   /* Sets output level of segment 0, output level of segment 1,2 and output level of segment 3,4 to –80 dBm, –85 dBm and –90 dBm. */
9. **TX_RX_SEG_DURATION 10** /* Sets the segment length to 10 ms. */
10. **TX_RX_MW 10,80** /* Sets the offset of the measurement enable interval to 10% and the ratio of
    measurement interval to 80%. */

    ---Start measurement---
11. **SNGLSTX_RX_FREQ 6,2** /* Starts measurement as the number of segments to 6 and the number of sequences to 2. */
12. **TX_RX_FREQ_READY?** /* Queries the ready state of Tx/Rx vs. Frequency Measurement. */
13. Repeat “TX_RX_FREQ_READY?” until “1” is responded.
14. Output signal to be measured from the UE.
15. **SWP?** /* Queries whether or not the measurement has been completed. */
16. Repeat “SWP?” until “0” is responded.
17. **MSTAT?** /* Queries the status of Tx/Rx vs. Frequency Measurement. */
18. **TX_RX_FREQ?** /* Queries the measured results. */

Notes:

- When Level continuous is set to ON, since Output level is restricted to 30 dB, an error sometimes occurs at measurement. Accordingly, before executing LVLCONT ON, set Output level to the maximum output level set at REGMRXPWR. In addition, it is better to set to the DL frequency giving the maximum External Loss (DL Main) before executing LVLCONT ON when there is an External Loss setting.

- If signal output is not required at segments in which only Tx measurement is performed, set the output frequency having a distance (at least the amount of measurement bandwidth) from the input frequency.

- If [Modulation] is set to [Off], unmodulated CW signal is output at all segments. For details, refer to the *MT8815B/MT8820B Operation Manual*.

1.2. Multi Power Measurement

The Multi Power Measurement is used to measure the average power of each step by outputting a step-shape signal from the UE for adjusting and confirming the transmission power.
This section describes an example of performing Multi Power Measurement, where a step-shape signal output from the UE is measured to obtain the average power of each step.

■ Programming example for remote control

1. **SCRSEL FMEAS** /* Selects Fundamental Measurement screen. */
2. **ULCHAN 9750** /* Sets Channel to 9750. */
3. **ILVL 20.0** /* Sets Input Level to 20.0 dBm. */
4. **MPMEAS_NUMSTEP 50** /* Sets Number of Step to 50. */
5. **MPMEAS_STEPTIME 10** /* Sets Power Step Time to 10 ms. */
6. **MPMEAS_TIMEOUT 15** /* Sets trigger detection timeout to 15 s. */
7. **MPMEAS_MW 10,80** /* Sets the offset of the measurement enable interval to 10% and the measurement interval rate to 80%. */

   ---Start measurement---
8. **SWPMPMEAS** /* Starts measurement in synchronized single mode. */
9. Output signal to be measured from UE
10. **MRFPWR? 0,50** /* Queries the measured results for 50 steps starting from Step 0. */

    To perform the measurement in single mode, carry out the following steps instead of steps 8-10.
    ---Start measurement---
8. **SNGLSMPMEAS** /* Starts measurement in single mode. */
9. **MPMEAS_READY?** /* Queries whether the MT8815B/MT8820B is ready for measurement. */
10. Repeat “MPMEAS_READY?” until the response indicating “1”.
11. Output signal to be measured from UE.
12. **SWP?** /* Queries whether or not the measurement has been completed. */
13. Repeat “SWP?” until the response indicating “0”.
14. **MSTAT?** /* Queries the status of Tx/Rx vs. Frequency Measurement. */
15. **MRFPWR? 0,50** /* Queries the measured results for 50 steps starting from Step 0. */

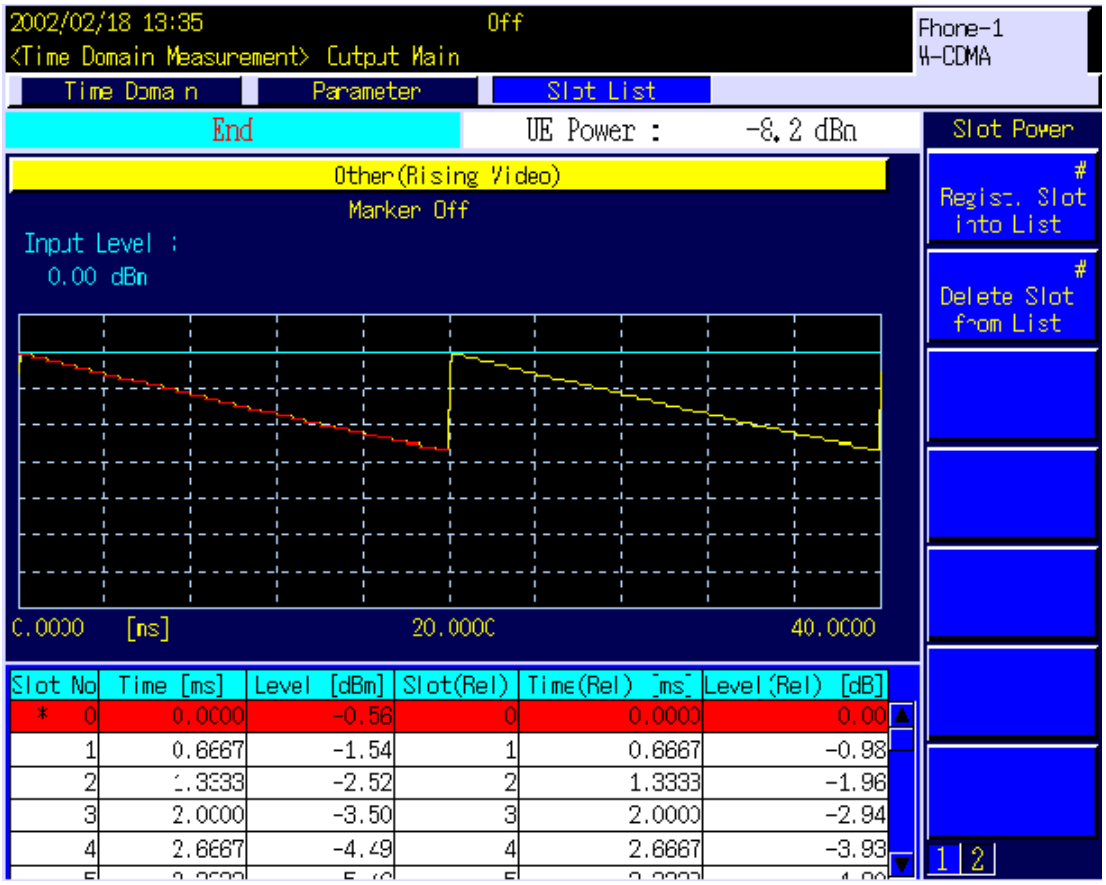
1.3. Tx Calibration using Slot List

The average power of sequential slots can be measured simultaneously when calibrating the UE Tx power using Time Domain Slot List.
Although the slot measurement range is preset to not include the transient area (25 µs from slot boundary), it can be set arbitrarily by changing the measurement start time (**PWRCALSTTM**) and measurement interval (**PWRCALDURAT**). The dynamic range (linearity) of the MT8820B/C is from Input Level to –40 dB (split the range when it exceeds –40 dB).

Rising Video, Falling Video and External Trigger can be used as triggers.

An example of how to measure a –1dB/slot difference and 2frame cycle is shown below.

1. **SCRSEL TDMEAS** /* Display the Time Domain Measurement screen. */
2. **MEASOBJ OTHER** /* Set [Measurement Object] to [Other]. */
3. **TRGSRC RISEVIDEO** /* Set [Trigger Source] to [Rising Video]. */
4. **ILVL 0.0DBM** /* Set [Input Level] to the output level of the UE. */
5. **SLOTLIST ON** /* Set [Slot List] to [On]. */
6. **REGSLOTLIST 0-29** /* Register Slot0~Slot29 for the slot list. */
7. **TIMESPAN 40.0MS** /* Set [Time Span] of Time Domain measurement to [40.0] ms. */
8. **TRGDELAY 0.0MS** /* Set [Trigger Delay] of Time Domain measurement to [0.0] ms. */
9. **SPMRBW 30KHZ** /* Set [RBW] to [30 kHz]. */
10. Output the signal from the UE.
11. **SWP** /* Perform measurement. */
12. **SLOT_PWR? ALL** /* Read the measurement result. */



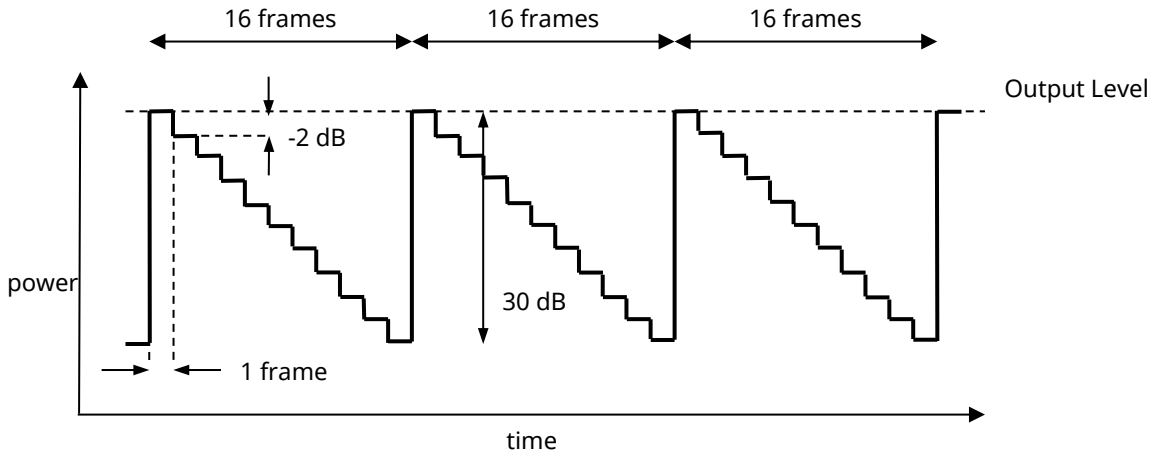
1.4. Rx Calibration by Sequential Output

Sequential Output function supports periodic changes of signal level output, increasing Rx level calibration efficiency.

[Sequential Output Specifications and Parameters]
The Sequential Output function supports periodic changes in the output level of each frame.
Setting of the tester is simplified and calibration time is cut by changing the signal level automatically.

When Sequential Output function is on, the Output level can be increased and decreased frame-by-frame.
The parameters are set at each frame change amount and frame cycle.
When the setting is negative, the output level decreases, when the setting is positive, the output level increases.
However, the Sequential Output can be changed by up to 30 dB. The absolute value of the variation cannot be changed above 30 (change cycle–1). In addition, the minimum level cannot be set lower than –140 dBm.

Setting examples are shown below
(Example) –2 dB/frame variation, 16 frame cycle



[Remote commands]

- Turn ON/OFF Sequential Output function.

  Command
  SEQOUTSW sw
  Query
  SEQOUTSW?
  Response
  sw
  Parameter
  sw ON Turn on Sequential Output function
  OFF Turn off Sequential Output function

- Setting change amount of Sequential Output function

  Command
  SEQOUTSTEP step
  Query
  SEQOUTSTEP?
  Response
  step
  Parameter
  step Setting change amount of Sequential Output function (each frame)
  The setting range is –30 to +30 dB and the setting resolution is 1 dB.
  However, the maximum amount of change is 30 dB (cycle variation–1)*.

- Setting change period of Sequential Output function.

  Command
  SEQOUTLENG length
  Query
  SEQOUTLENG?
  Response
  length
  Parameter
  length Setting change period of Sequential Output function
  The setting range is 2 to 31 frames and the setting resolution is 1 frame.
  However, the maximum amount of change is 30 dB (cycle variation–1)*.

- Setting Sequential Output function parameter

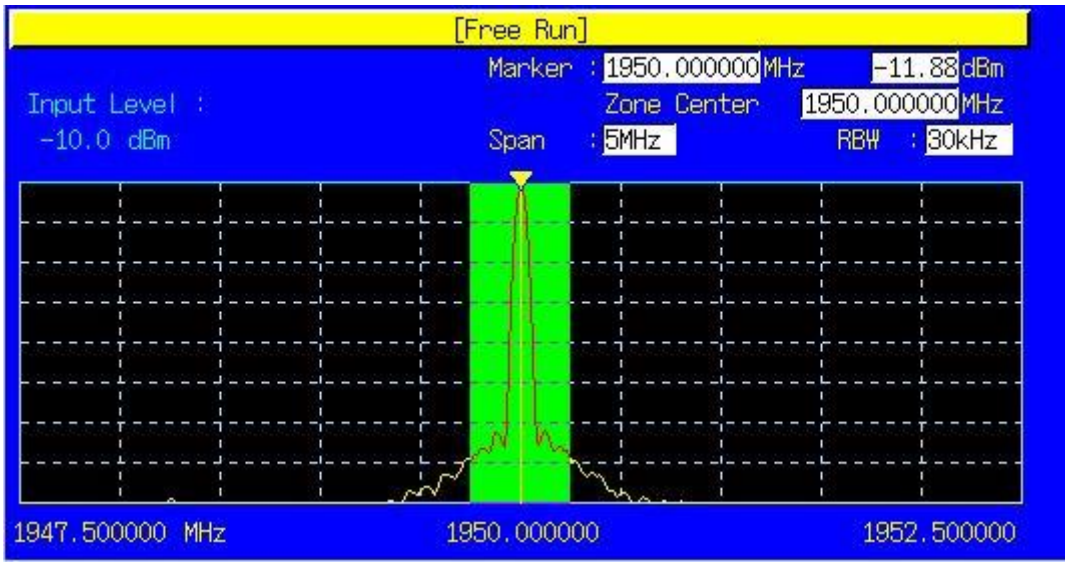
  Command
  SEQOUT step,length,sw
  Query
  SEQOUT?
  Response
  step,length,sw
  Parameter
  step Setting output change amount of Sequential Output function
  The setting range is –30 to +30 dB and the setting resolution is 1 dB.
  However, the maximum amount of change is 30 dB (cycle variation–1)*.
  length Setting output change period of Sequential Output function
  The setting range is 2 to 31 frames and the setting resolution is 1 frame.
  However, the maximum amount of change is 30 dB (cycle variation–1)*.
  sw ON Turn on Sequential Output function
  OFF Turn off Sequential Output function

[Examples of remote control]

send(OLVL -60.0 dBm): /* Set reference output level to –60.0 dBm */
send(SEQOUT 2,16,ON): /* Set change amount of 1 frame to 2 dB, change period to 16 frames, and turn on Sequential Output */

1.5. Frequency Measurement by Spectrum Monitor

Sometimes, frequencies are measured by outputting a CW signal from the UE when adjusting the UE output frequency. The MT8820B/C spectrum monitor function can measure CW signal frequencies.



1) Frequency measurement using remote command **PEAKFRQ?**

The CW signal frequency can be measured with higher accuracy than the spectrum monitor display resolution. The measurement accuracy is ±100Hz when the Frequency Span is 25 MHz, and ±10 Hz when the Frequency Span is 5 MHz.

1. **SCRSEL SPMON** /* Display the Spectrum Monitor screen. */
2. **ULFREQ 1950.0MHZ** /* Set [UL Frequency] to [1950.0] MHz. */
3. **ILVL 0.0DBM** /* Set [Input Level] to the UE output level. */
4. **SPMSPAN 5** /* Set [Frequency Span] to [5 MHz]. */
5. **SPMRBW 30KHZ** /* Set [RBW] to [30 kHz]. */
6. **SPMAVG 10** /* Set [Average Count] to [10] times. */
7. Output a signal from the UE.
8. **SWP** /* Perform measurement. */
9. **PEAKFRQ?** /* Read the frequency measurement result. */

2) Frequency and level measurement using zone marker

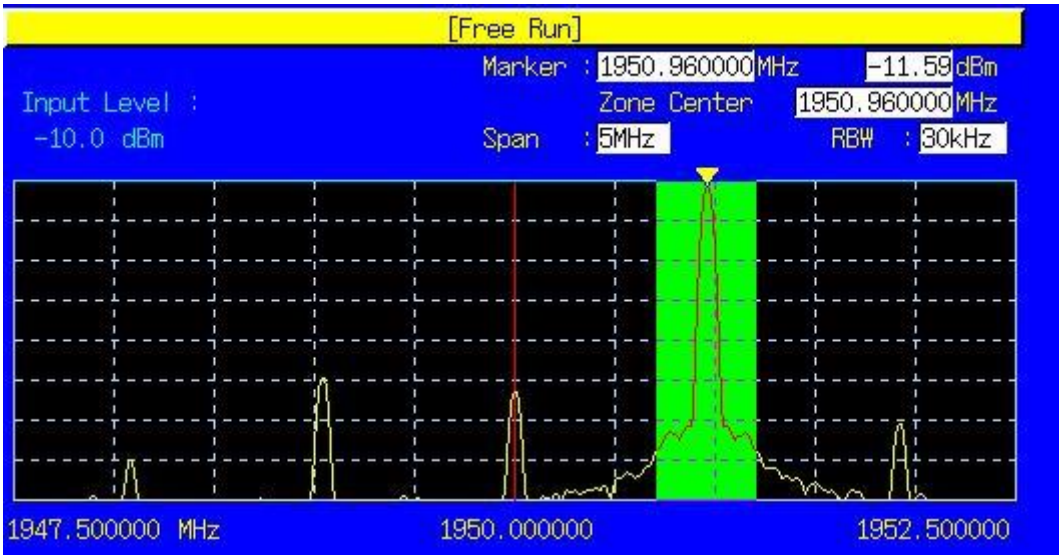
The Zone marker supports measurement of frequency and level by searching the maximum level inside a zone. The Zone width is 1/10 of the Frequency Span.

1. **SCRSEL SPMON** /* Display the Spectrum Monitor screen. */
2. **ULFREQ 1950.0MHZ** /* Set [UL Frequency] to [1950.0] MHz. */
3. **ILVL 0.0DBM** /* Set [Input Level] to the UE output level. */
4. **SPMSPAN 5** /* Set [Frequency Span] to [5 MHz]. */
5. **SPMRBW 30KHZ** /* Set [RBW] to [30 kHz]. */
6. **ZMKR_SPM ON** /* Set [Zone Marker] to [On]. */
7. **ZMKP_SPM 1950.0MHZ** /* Set the marker position to 1950.0 MHz. */
8. **SPMAVG 10** /* Set [Average Count] to [10] times. */
9. Output the signal from the UE.
10. **SWP** /* Perform measurement. */
11. **ZMKRF_SPM?** /* Read the frequency measurement result. */
12. **ZMKRL_SPM?** /* Read the level measurement result. */

The measured signal should be within –30 dB from the input level.

1.6. Orthogonal Modulator Adjustment Using Spectrum Monitor

At adjustment of the UE orthogonal modulator, the carrier leak and image level are measured by outputting a rotating pattern from the UE. To support this measurement, the spectrum monitor has a Normal Marker function, supporting simultaneous readout of levels at any five frequency points. The Normal Marker function can specify five frequency points separately from the on-screen Zone marker. Marker values can be read simultaneously and measurement can be performed quickly at adjustment. The Normal Marker function is executed only by remote command and measurement results are not displayed on the spectrum monitor screen.



1. **SCRSEL SPMON** /* Display the Spectrum Monitor screen. */
2. **ULFREQ 1950.0MHZ** /* Set [UL Frequency] to [1950.0] MHz. */
3. **ILVL 0.0DBM** /* Set [Input Level] to the UE output level. */
4. **SPMSPAN 5** /* Set [Frequency Span] to [5 MHz]. */
5. **SPMRBW 30KHZ** /* Set [RBW] to [30 kHz]. */
6. **MKRP_SPM 1948.08MHZ, 1949.04MHZ, 1950.0MHZ, 1950.96MHZ, 1951.92MHZ**
   /* Set the marker point. */
7. Output a signal from the UE.
8. **SWP** /* Perform measurement. */
9. **MKRL_SPM?** /* Read the marker level. */

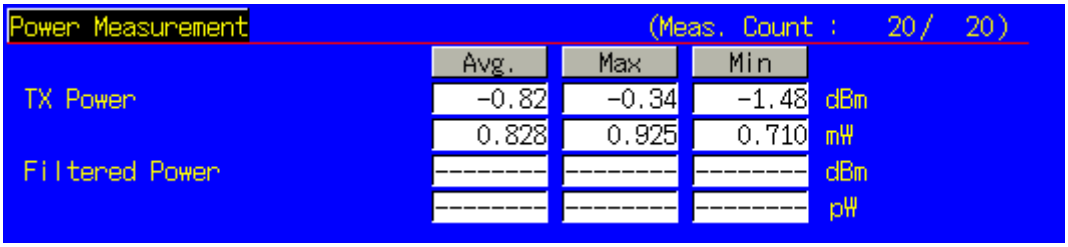
Function		Command	Query	Response	Remarks
Zone Marker					
Marker On / Off	Off	ZMKR_SPM OFF	ZMKR_SPM?	OFF	
	On	ZMKR_SPM ON		ON	
Marker Position		ZMKRP_SPM freq	ZMKRP_SPM?	freq	Freq: frequency [1]
Read Out Marker Level		-----	ZMKRL_SPM?	level	Unit = dBm
Read Out Marker Frequency		-----	ZMKRF_SPM?	freq	Freq: frequency [2]
Normal Marker					
Marker Position		MKRP_SPM f1,f2,f3,f4,f5 MKRP_SPM f1,,,f5	MKRP_SPM?	f1,f2,f3,f4,f5	fn,f1~f5: frequency [2]
			MKRP_SPM? n	fn	n: 1~5
Read Out Marker Level		-----	MKRL_SPM?	l1,l2,l3,l4,l5	Unit = dBm
			MKRL_SPM? n	level	N: 1~5, l: Unit = dBm
Peak Frequency			PEAKFRQ?	freq	Unit = Hz
Spectrum Data		-----	XMA? P,d	b,b,b,b……	P: Start Position 0~500 b: Data –32768~32767 d: Data Length 1~501

[1] Frequency = (Input Frequency - Frequency Span x 0.45) ~ (Input Frequency + Frequency Span x 0.45)
[2] Frequency = (Input Frequency - Frequency Span x 0.5) ~ (Input Frequency + Frequency Span x 0.5)

1.7. Tx Power Measurement with Fast Power Measurement Mode

When measuring Tx power at UE adjustment and the signal power is stable, power can be measured faster than normal by turning on the Fast Power Measurement Mode.
However, other Tx measurement items are not performed when the Fast Power Measurement Mode is on.

1. **SCRSEL FMEAS** /* Display the Fundamental Measurement Screen. */
2. **FASTPWRMODE ON** /* Set [Fast Power Measurement Mode] to [On]. */
   (Execute **FASTPWR_RRC ON** to measure Filtered Power.)
3. **PWR_MEAS ON** /* Set [Power Measurement] to [On]. */
4. **PWR_AVG 20** /* Set [Average Count] of power measurement to [20] times. */
5. **ILVL 0.0DBM** /* Set [Input Level] to the UE output level. */
6. Output a signal from the UE.
7. **SWP** /* Perform measurement. */
8. **MKRL_SPM?** /* Read the marker level. */



2. GSM Measurement Software

2.1. Multi Burst RF Power Measurement

Measures each transmission power of the multi-burst.
Output power can be adjusted quickly by changing the DUT output power in sequence. The maximum number of measurable bursts is 500.
Multi-burst RF Power measurement is executed only by remote command. The measurement result is not displayed on the unit screen. It can be acquired only by remote commands.

[Specification of measuring signals]
The GSM modulation signal (MS-Normal Burst) and EGPRS modulation signal (8PSK) are measured. Output at the GSM timing is presupposed. However, measurement does not have to be synchronized with the unit Downlink signal. The DUT output power control is set to repeat at a fixed frame number. Multi-burst RF Power measurement ignores Idle frames.

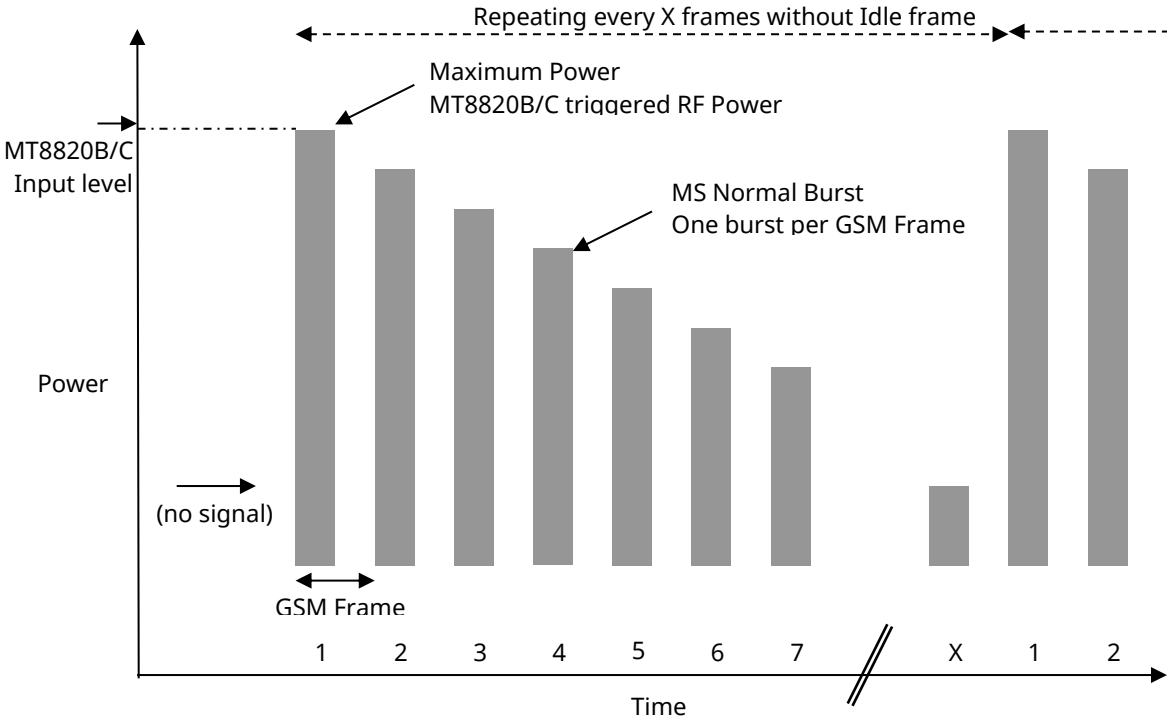


Figure 2.1-1: Measuring Multi-Burst RF Power Measurement Signals

The measurement procedures are shown below.
- Stop the DUT output and enter standby after making the required settings.
- Set the required parameters (such as Call Processing OFF).
- Set the maximum DUT output power as the unit Input level, so the input is not saturated.
- Send the Multi-burst Power Measurement command to the unit, and enter standby.
- Start the DUT output.
- Measurement starts when the unit detects a signal. The threshold value for signal detection is the Input Level –30 dB (approx.) and measurement is triggered when the signal is input at a higher level.
- Stop the DUT output and read the measurement result from the unit.

[Remote Command Specifications]

- Starting Multi-burst RF Power measurement

Command

SWPMRFPWR n

Parameter

n: Number of bursts to measure

Parameter n can be omitted. If n is omitted, measurement is performed using 100 as the preset number of bursts.

- Querying measurement result (output power)

Query

MRFPWR?

Response

$p_1,p_2,p_3,...p_n$

"p_x" returns the measured burst power in dBm units to two decimal places.
"n" indicates the number of measured bursts specified by the SWPMRFPWR command.

- Querying measurement result (burst status)

Query

MRFPWRSTAT?

Response

$s_1,s_2,s_3,...s_n$

"s_x" indicates each burst status. The type of status is described later.
"n" indicates the number of measured bursts specified by the SWPMRFPWR command.

- Querying all measurement results

Query

MRFPWRALL?

Response

$s_1,p_1,u_1,l_1,s_2,p_2,u_2,l_2,...s_n,p_n,u_n,l_n$

"s_x" indicates burst status. The type of status is described later.

"p_x" returns the measured burst power in dBm units to two decimal places.

"u_x" returns the maximum value of burst ON segment in dB units to two decimal places.

"l_x" returns the minimum value of burst ON segment in dB units to two decimal places.
"n" indicates the burst number specified by the SWPMRFPWR command.

- Querying all measurement status

Query

MSTAT?

Response

status

The method for using the [MSTAT?] Query and the Response status are similar to the procedure for Fundamental measurement.
See the MX882001C GSM Measurement Software Operation Manual for details.
See the error status item below for the Multi-burst RF Power measurement error status.

- Timeout setting

Command

MRFPWR_TIMEOUT time

Query

MRFPWR_TIMEOUT?

Response

time

Parameter

time

"*time*" indicates the timeout duration. The setting range is 1 to 60 s with a resolution of 1 s.
The preset value is 10 s.

[Error status]

The relationship between [error status s_X for each burst] and [error status for all measurement] is shown in Table 2.1-1. The error status depends on the burst status. When all burst status s_X is Normal, the error status becomes Normal. When Signal Abnormal is detected in any of burst status s_X, the error status becomes Signal Abnormal.

Table 2.1-1: Burst Status and Error Status

Burst status "s_X" by "*MRFPWRSTAT?*"	Description for "s_X"	Measurement status "*status*" by "*MSTAT?*"	Description for "*status*"
0	Normal	0	Normal
1	(Reserved)	-	---
2	Level over	2	Level over
3	(Reserved)	-	---
4	Signal Abnormal	4	Signal Abnormal
5	Training sequence not found	4	Signal Abnormal
6	(Reserved)	-	---
7	(Reserved)	-	---
8	(Reserved)	-	---
9	(Reserved)	9	Not yet measured
10	(Reserved)	-	---
11	(Reserved)	-	---
12	(Reserved)	12	Time out
13	(Reserved)	-	---
14	Burst short	4	Signal Abnormal
15	Power flatness max/min fail	4	Signal Abnormal

[Error Status Detection Procedure]

The detection sequence for the burst status s_X and error status are shown in Figure 2.1-2.

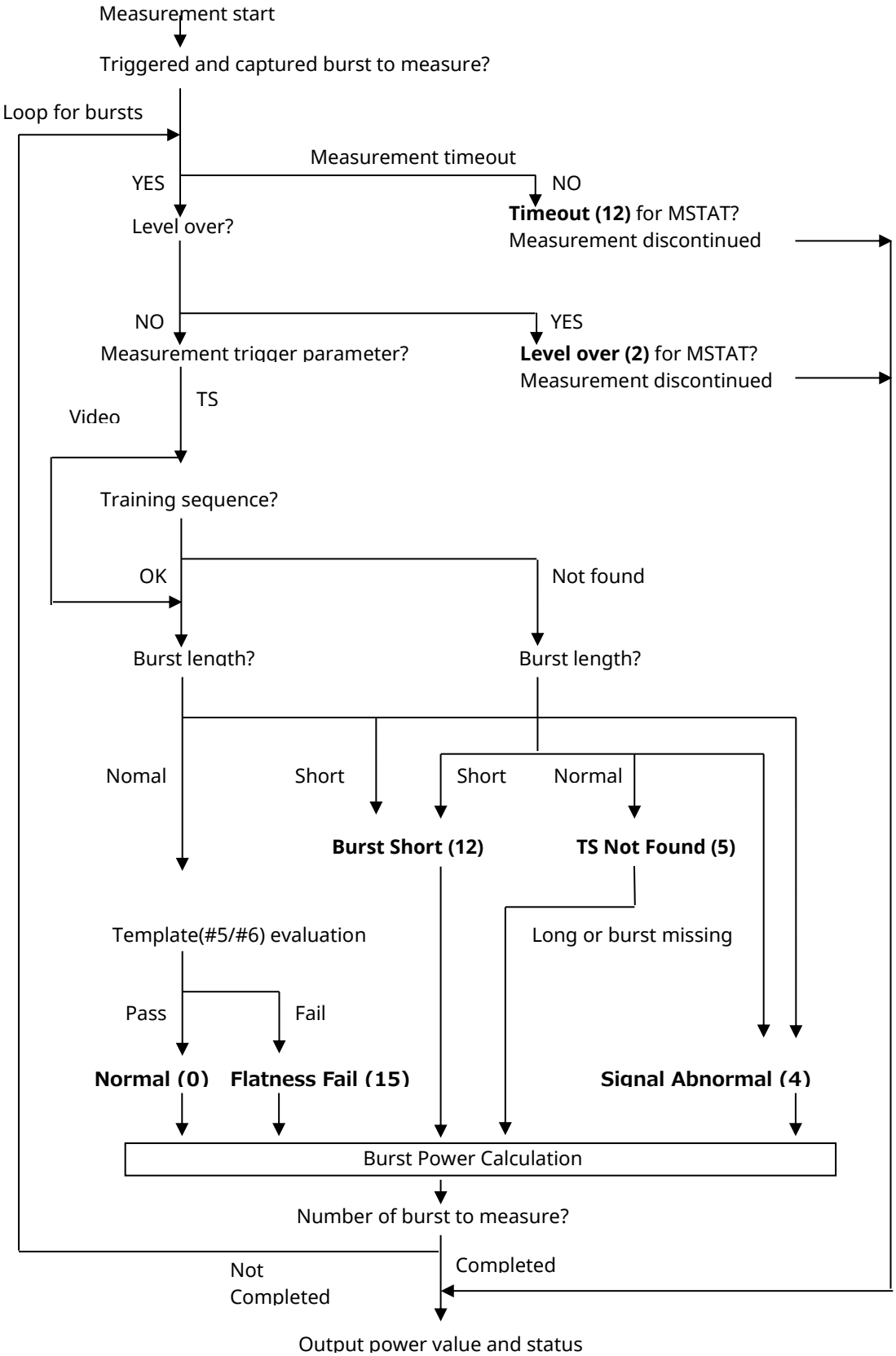


Figure 2.1-2: Error Status Detection Procedure

2.1.1. Example for Remote Control Measurement

An example for the remote control measurement is as follows.

■ Programming example for remote control

1. Turn off the RF signal of the phone
2. **CALLPROC OFF** /* Sets Call Processing OFF. */
3. **MEASOBJ MSNB** /* Sets measuring object to Normal Burst. */
4. **CHAN 62** /* Sets the channel of the RF signal 62. */
5. **ILVL 27DBM** /* Sets Input Level 27 dBm. */
6. **MRFPWR_TIMEOUT 20** /* Sets Timeout Length to 20 seconds. */
7. **SWPMRFPWR 32** /* Starts Multi-Burst RF Power Measurement for 32 Bursts. */
8. Turn on the RF signal of the phone.
9. Wait until “End” is displayed.
10. **MRFPWRALL?** /* Queries all results of the Multi-Burst RF Power Measurement. */

2.1.2. Power Estimate Function for 8PSK

The power level of the 8PSK modulation signal fluctuates rapidly, making stable power measurement difficult. Usually, the average of two or more bursts is used to reduce the difference between measured values. Using this Power Estimate Function for 8PSK reduces the difference between measured values and eliminates the need for averaging.

■ Programming example for remote control

1. Turn off the RF signal of the phone.
2. **MRFPWR_METHOD ESTIMATE** /* Sets RF measurement method to ESTIME. */
3. **OPEMODE EGPRS** /* Sets Operating Mode to EGPRS. */
4. **CALLPROC OFF** /* Sets call processing OFF. */
5. **MEASOBJ 8PSK** /* Sets measuring object to 8PSK. */
6. **CHAN 62** /* Sets the channel of the RF signal 62. */
7. **ILVL 27DBM** /* Sets Input Level 27 dBm. */
8. **MRFPWR_TIMEOUT 20** /* Sets Timeout Length to 20 s. */
9. **SWPMRFPWR 32** /* Starts multi-burst RF power measurement for 32 burst. */
10. Turn on the RF signal of the phone.
11. Wait until “End” is displayed.
12. **MRFPWRALL?** /* Queries all results of the Multi-Burst RF Power Measurement. */

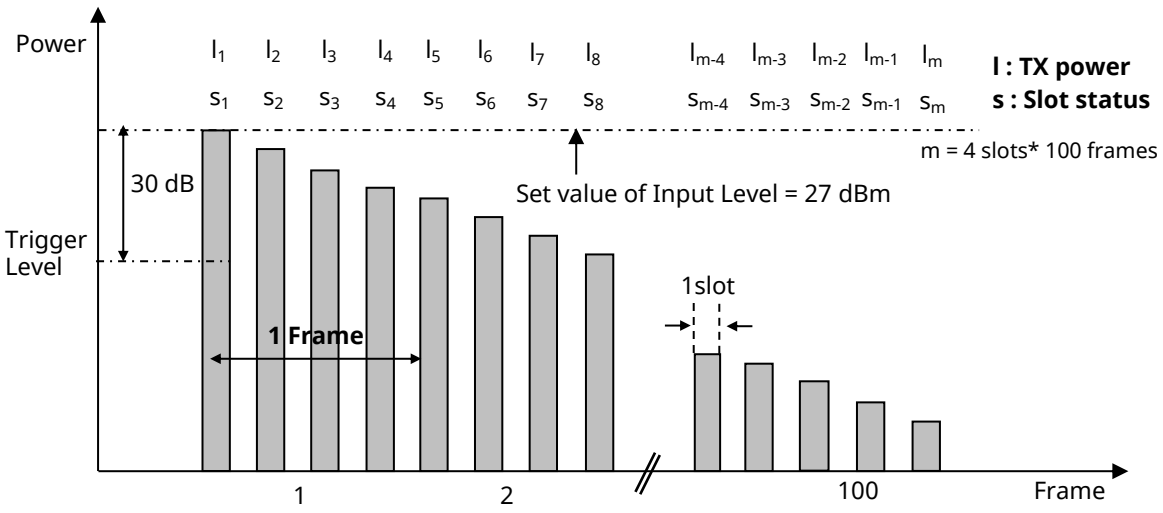
2.2. Multi Burst RF Power Measurement (Multislot)

Measures each transmission power of the multi-burst.

An example for the remote control measurement is as follows.

■ Programming example for remote control

1. Turn off the RF signal of the phone.
2. **CALLPROC OFF** /* Sets Call Processing OFF. */
3. **OPEMODE EGPRS** /* Sets Operating Mode to EGPRS. */
4. **MEASOBJ 8PSK** /* Sets measuring object to 8PSK. */
5. **CHAN 62** /* Sets the channel of the RF signal 62. */
6. **ILVL 27DBM** /* Sets Input Level 27 dBm. */
7. **TSPAT TSC5** /* Sets the training sequence code to TSC0. */
8. **MEASSEL MRFPWR** /* Sets Measurement Select to Multi Burst RF Power (Multislot). */
9. **MRFPWR_TIMEOUT 20** /* Sets Timeout Length to 20 seconds. */
10. **MRFPWR_METHOD ESTIMATE** /* Sets RF measurement method to ESTIME. */
11. **MRFPWR_SLOT OFF,ON,OFF,ON,OFF,ON**
    /* Sets slot2, slot4, slot6 to enable. */
12. **MRFPWR_FRAME 100** /* Sets number of frames to 100 frames. */
13. ***OPC?** /* Wait for setting completion. */
14. Repeat "*OPC? " until the response indicating "1".
15. **SNGLS** /* Starts measurement. */
16. Turn on the RF signal of the phone.
17. Repeat "MSTAT?" until the response not indicating "9".
18. **MRFPWRSTATMLTSLT?** /* Queries measurement status of each slot. */
19. **MRFPWRMLTSLT?** /* Queries TX power result of each slot. */
    ---Following commands set at Multi-Burst RF Power Measurement (Multislot) completion---
20. **MEASSEL FMEAS** /* Sets Measurement Select to Fundamental. */



2.3. Phase Error Measurement by Multiframe Phase Error Measurement

Multiframe Phase Error measurement supports batch measurement of RMS Phase Error for 1 Multiframe excluding the Idle frame. (However, the burst signal is 25 bursts, allocating 1 slot to 1 Frame.) This is effective for high-speed measurement of RMS Phase Error at different parameters during MS inspection.
Starting Multiframe Phase Error measurement and reading results are performed by remote command.
Measurement results are not displayed on the unit screen.

[Measurement parameters]
Measurement is executed after setting the parameters shown in Table 2.3-1 and sending the Multiframe Phase Error measurement command by remote control.

Table 2.3-1: Multiframe Phase Error Measurement Parameter Setting

No	Parameter	Setting
1	Call Processing	OFF
2	Measuring Object	MS-NB

[Measured signals]
The signal is the GSM modulation signal and the timing must be at the GSM output timing. Measurement is performed in 25 frame segments, starting from the frame after the Idle frame (Figure 2.3-1). At Multiframe Phase Error measurement, the average number of measurements can be specified using an argument. When the average number is two or more, 1 Multiframe is regarded as one measurement segment and measurement results are averaged per corresponding slot.

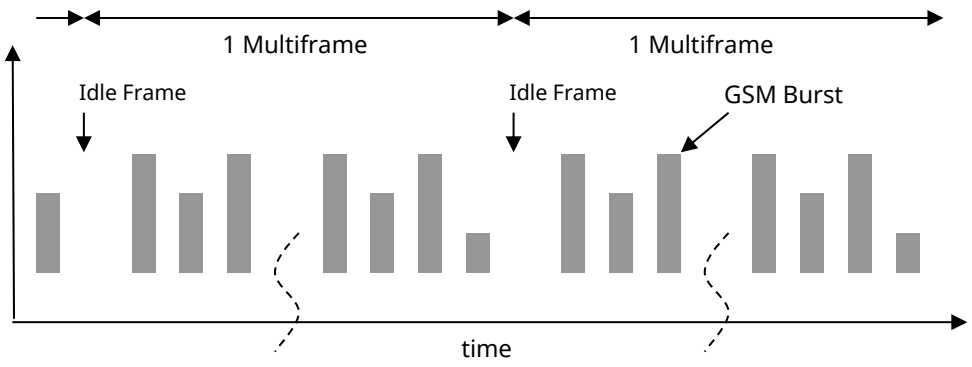


Figure 2.3-1: : Multiframe Phase Error Measurement Signal

[Remote command]
Measurement starting command
SWPMPHASEERR n

Parameter
n Average count, n=1 when omitted.

Measurement result query
MPHASEERR? m

Parameter
m Number of frames read as a measurement result, n=25 when omitted.

[Example of remote control]
Performing Multiframe Phase Error measurement 10 times and query the average value:

1. **CALLPROC OFF** /* Call Processing OFF. */
2. **MEASOBJ MSNB** /* Set measurement object to Normal Burst. */
3. **SWPMPHASEERR 10** /* Start Multiframe Phase Error measurement 10 times and starts the average value. */
4. **MPHASEERR? 25** /* Multi Frame Phase Error Measurement Result Reading Command and Read Multi Frame Phase Error Measurement Results */

2.4. Predistortion Measurement 1

This section explains how to measure the transmission power and phase of the setting interval for the predistortion adjustment.

An example for the remote control measurement is as follows.

■ Programming example for remote control

1. Turn off the RF signal of the phone.
2. **CALLPROC OFF** /* Sets Call Processing OFF. */
3. **CHAN 62** /* Sets the channel of the RF signal 62. */
4. **ILVL 27DBM** /* Sets Input Level 27 dBm. */
5. **TX_TOMODE ON,20** /* Sets Timeout 20 s. */
6. **SNGLSPREDISTQ 1000,200,0.8,0** /* Starts Predistortion Measurement 1. */
   /* Duration: 1000 µs */
   /* Number of the measurement periods: 200 */
   /* Ratio: 0.8 */
   /* Trigger Type: 0 */
7. **PREDIOTE_READY?** /* Executes polling until response becomes “1:Ready”. */
8. Turn on the RF signal of the phone.
9. **PREDISTQ_POWER? 200** /* Queries power result of each measurement period. */
10. **PREDISTQ_PHASE? 200** /* Queries phase result of each measurement period. */

2.5. Predistortion Measurement 2

This section explains how to measure the Amplitude and phase of each sampling point for the predistortion adjustment.

An example for the remote control measurement is as follows.

■ Programming example for remote control

1. Turn off the RF signal of the phone.
2. **CALLPROC OFF** /* Sets Call Processing OFF. */
3. **CHAN 62** /* Sets the channel of the RF signal 62. */
4. **ILVL 27DBM** /* Sets Input Level 27 dBm. */
5. **TX_TOMODE ON,20** /* Sets Timeout 20 s */
6. **SWPPREDISTE –30,–1152** /* Starts Predistortion Measurement 2. */
   /* Trigger Level: –30 [dB] */
   /* Delay: –1152 [sample] */
7. Turn on the RF signal of the phone.
8. Confirm that “End” is displayed on the measurement indicator.
9. **PREDISTE_AMP? –192,8192** /* Queries the power results of each sampling point */
10. **PREDISTE_PHASE? –192,8192** /* Queries the phase results of each sampling point */

2.6. IQ Capturing Measurement

IQ Capturing measurement outputs the signal sent from the mobile as a band-limited baseband signal.

The remote control measurement examples are as follows.

■ Programming example for remote control

1. Stop output of the signal from the mobile station(MS).
2. **CALLPROC OFF** /* Sets Call Processing to OFF. */
3. **LVL OFF** /* Sets RF Signal output to OFF. */
4. **ILVL 10DBM** /* Sets Input Level to 10 dBm. */
5. **ULFREQ 890.2MHZ** /* Sets UL frequency to 890.2 MHz. */
6. **TX_TOMODE ON,20** /* Sets Timeout to 20 s. */

   --- “IQCAP_MEAS ON” can be set only when IQ Capturing measurement is performed. ---
7. **IQCAP_MEAS ON** /* Enables IQ Capturing measurement. */
8. **IQCAP_BW 1MHZ** /* Sets Reception Bandwidth 1 MHz. */
9. **IQCAP_TRGDLY -100** /* Sets trigger delay –100 μs. */
10. **IQCAP_TSPAN 5000** /* Sets Time Span 5000 μs.*/
11. **SWP** /* Measure */
12. Output the signal from the mobile station(MS).
13. **SWP?** /* Queries whether or not the measurement has been completed. */
14. Repeat “SWP? ” until the response indicating “0”.
15. **MSTAT?** /* Queries the measurement status. */
16. **IQCAP_RATE?** /* Queries the sampling rated. */
17. **IQCAP_NUM?** /* Queries the sampling count. */
18. **IQCAP_BIN? 2,20,500** /* Captures IQ data from 20 to 500. */

    --- “IQCAP_MEAS OFF” can be set when IQ Capturing measurement ends. ---
19. **IQCAP_MEAS OFF** /* Disables IQ Capturing measurement. */

2.7. High-Speed Adjustment Measurement

The GSM High-Speed Adjustment Measurement function is for rapidly adjusting the mobile station (MS) transmitter and receiver. It is composed of the RX Sweep signal generator used to adjust the receiver of the mobile station (MS) and the TX Sweep used to adjust the transmitter of the mobile station(MS).

2.7.1. Rx Sweep Measurement

An example of the RX Sweep remote program is described here using the example of signal generation control shown in Table 2.7-1. Since the output level range is more than 30 dB, RX Sweep is executed twice.
If the output level range is more than 30 dB for the MT8820C, RX Sweep is executed once.

Table 2.7-1 RX Sweep output signal example

Band	Frequencies in MHz	Power Levels in dBm	Repeat
FCCH, SCH	935.2	–40.0, –75.0	1 frame
Ignored frames	935.2	OFF	4 frames
PGSM900	935.2, 947.4, 959.8	–20.0, –30.0, –40.0, –50.0, –65.0, –75.0	1 frame
DCS1800	1805.2, 1842.8, 1879.8	–20.0, –30.0, –40.0, –50.0, –65.0, –75.0	1 frame

Because the output level is from – 20 to – 75, two output level lists are set as shown in Figure 2.7-1.

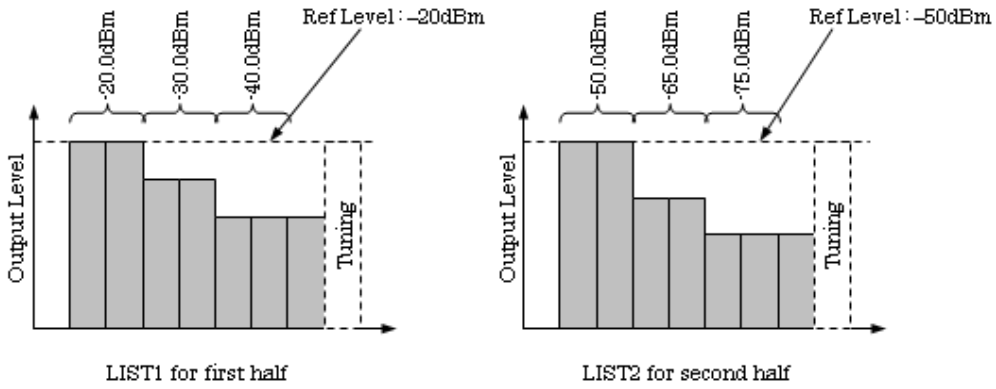


Figure 2.7-1 Output level list

■ Programming example for remote control

---Preparation---

1. **PRESET** /* Initializes all parameters. */
2. **CALLPROC OFF** /* Sets Call Processing OFF. */
3. **EXTLOSSW ON** /* Enables External Loss. */
4. **DLEXTLOSS BAND2,1.0** /* Sets External Loss for Main I/O DL side at Band2 to 1.0 dB */
5. **DLEXTLOSS BAND3,1.0** /* Sets External Loss for Main I/O DL side at Band3 to 1.0 dB */

--- "HSADJ ON" can be set when the measurement starts.---

6. **HSADJ ON** /* Sets High-Speed Adjustment to Enable */
7. **REGMRXPWR LIST1,-20.0,-20.0,-30.0,-30.0,-40.0,-40.0,-40.0**
   /* Sets the output level list for LIST1 */
8. **REGMRXPWR LIST2,-50.0,-50.0,-65.0,-65.0,-75.0,-75.0,-75.0**
   /* Sets the output level list for LIST2*/
9. **REGMRXFREQ1 935.2,935.2, 935.2,935.2,947.4,959.8,1805.2,1842.8,1879.8**
   /* Sets the output frequency for each step. */
10. **REGMRXBTYPE1 FCCH,SCH,PRBS,PRBS,PRBS,PRBS,PRBS,PRBS,PRBS**
    /* Sets burst type for each step. */
11. **RXSWPREPEAT1 1,1,4,1,1,1,1,1,1**
    /* Sets frame repetition count for each step. */
12. **RXSWPSTEPS 9** /* Sets the RX Sweep sequence step count. */

---Execute RX Sweep firstly (Ref. Level: –20 dBm).---

13. **REGMRXPCFG1 -40.0,-40.0,OFF,LIST1,LIST1,LIST1,LIST1,LIST1,LIST1**
    /* Sets Output Level for each step. */
14. **OLVL -20.0dBm** /* Sets Output Level to –20 dBm. */
15. ***OPC?** /* Wait for setting completion. */
16. Repeat "*OPC? " Query until "1" response.
17. **LVLCONT ON** /* Sets Level Continuous to ON. */
18. **RXSWP START** /* Starts RX Sweep. */
19. Output the signal from the mobile station(MS).
20. **RXSWP STOP** /* Stops RX Sweep. */
21. **LVLCONT OFF** /* Sets Level Continuous to OFF*/

---Execute RX Sweep secondly (Ref. Level: –50 dBm)---

22. **REGMRXPCFG1 -75.0,-75.0,OFF,LIST2,LIST2,LIST2,LIST2,LIST2,LIST2**
    /* Sets Output Level for each step. */
23. **OLVL -50.0dBm** /* Sets Output Level to –50 dBm. */
24. ***OPC?** /* Wait for setting completion. */
25. Repeat "*OPC? " Query until "1" response.
26. **LVLCONT ON** /* Sets Level Continuous to ON*/
27. **RXSWP START** /* Start RX Sweep. */
28. Mobile station(MS) receives the signal output.
29. **RXSWP STOP** /* Stop RX Sweep. */
30. **LVLCONT OFF** /* Sets Level Continuous to OFF. */

---"HSADJ OFF" can be set when RX Sweep ends---

31. **HSADJ OFF** /* Disables High-Speed Adjustment Function. */

2.7.2. Tx Sweep Measurement

An example of the TX Sweep remote program is described here.
This section explains an example of the TX Sweep measurement sequence at the frequency conditions listed in Table 2.7-2.

Table 2.7-2 TX Sweep measurement example

Band	Frequencies in MHz	Power Measurement Range	Averaging
PGSM900	890.2, 902.4, 914.8	+33 dBm to +7 dBm, 2 dB step	5
DCS1800	1710.2, 1747.8, 1784.8	+30 dBm to +4 dBm, 2 dB step	5

The signal to be measured has a difference of 26 dB between the maximum and minimum levels and a step size of 2 dB, so there are four input patterns as shown in Figure 2.7-2.

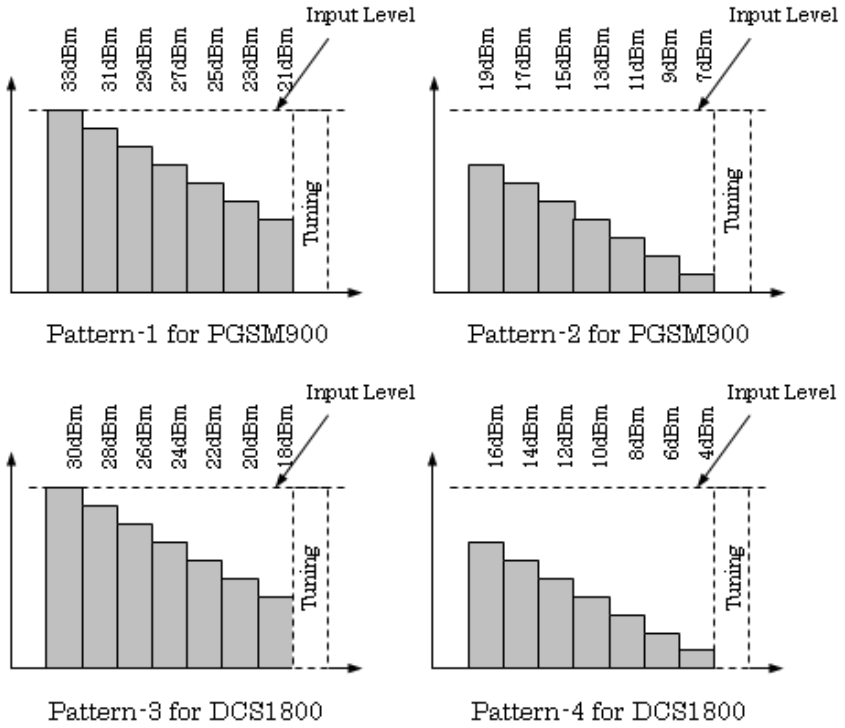


Figure 2.7-2 Tx Sweep input pattern

Consequently, the TX Sweep measurement sequence can be set as shown in Figure 2.7-3.

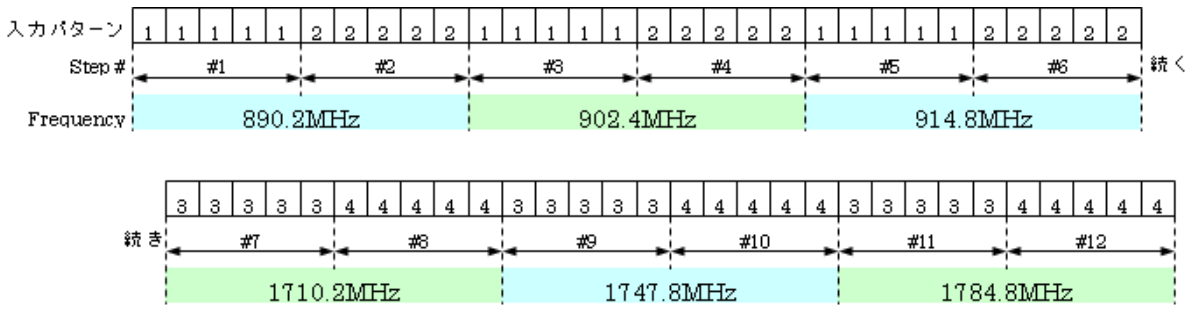


Figure 2.7-3 Tx Sweep measurement sequence

■ Remote Control Program Example

---Preparation---

1. **PRESET** /* Initializes all parameters. */
2. **CALLPROC OFF** /* Sets call processing to OFF. */
3. **EXTLOSSW ON** /* Enables External Loss. */
4. **DLEXTLOSS BAND2,1.0** /* Sets External Loss for Main I/O DL side at Band2 to 1.0 dB. */
5. **DLEXTLOSS BAND3,1.0** /* Sets External Loss for Main I/O DL side at Band3 to 1.0 dB. */

--- “HSADJ ON” can be set when the measurement starts. ---

6. **HSADJ ON** /* Enables High-Speed Adjustment Function. */
7. **REGMTXFREQ1 890.2,890.2,902.4,902.4,914.8,914.8,1710.2,1710.2,1747.8,1747.8,1784.8,1784.8** /* Sets input frequency at each step. */
8. **TXSWPREPEAT1 5,5,5,5,5,5,5,5,5,5,5,5** /* Sets Frame repetition at each step. */
9. **TXSWPSTEPS 12** /* Sets TX Sweep sequence number. */
10. **ILVL 33.0dBm** /* Sets Input Level to 33 dBm. */
11. ***OPC?** /* Wait for setting completion. */
12. Repeat “*OPC? ” Query until “1” response.
13. **TXSWP ON** /* Enables TX Sweep. */
14. **SWP** /* Starts TX Sweep. */
15. Signal output from mobile station(MS).
16. **SWP?** /* Queries whether or not the measurement has been completed. */
17. Repeat "SWP?" Query until “0” response.
18. **TXSWP_STAT?** /* Queries measurement status at each step. */
19. **TXSWP_AVG_TXPWR?** /* Queries measurement results. */

---Following commands set at TX Sweep measurement completion---

20. **TXSWP OFF** /* Disables TX Sweep. */
21. **HSADJ OFF** /* Disables High-Speed Adjustment function. */

2.8. Multislot Power vs. Time Measurement

This function measures the TX Power and Power vs. Time for multislot output from the mobile station (MS).

The remote control measurement examples are as follows.

■ Programming example for remote control

1. **CALLPROC ON** /* Sets Call Processing to On. */
2. **CHAN 62** /* Sets TCH channel to 62 CH. */
3. **ILVL 27DBM** /* Sets Input Level to 27 dBm. */
4. **OPEMODE EGPRS** /* Sets Operating mode to EGPRS. */
5. Register mobile station(MS) location.
6. **MLTSLTCFG 2DL2UL** /* Sets multislot to 2DL2UL. */
7. **CALLSA** /* Sets call connection. */
8. **CALLSTAT?** /* Queries the Call Processing status. */
9. Repeat “CALLSTAT? ” until the response indicating “12”.
10. **MLTSLTVSTIME_MEAS ON** /* Sets Multislot Power vs. Time measurement to ON. */
11. **MLTSLTVSTIME_COUNT 10** /* Sets Multislot Power vs. Time measurement count to 10. */
12. **MPWR_LEADTM 1,2,-20.5** /* Sets Leading Time2 to –20.5 µs at 1st Slot. */
13. **MPWR_TRAILTM 1,3,555.8** /* Sets Leading Time3 to 555.8 µs at 1st Slot. */
14. **SWP** /* Starts measurement. */
15. **SWP?** /* Queries whether or not the measurement has been completed. */
16. Repeat “SWP? ” until the response indicating “0”.
17. **MTXPWR? 1,DBM** /* Queries the transmission power for 1st Slot. */
18. **TTL_MTXPWR? 1,DBM** /* Quarries the 1st pass/fail result, average, maximum and minimum values of transmission power. */
19. **TTL_MPTLEAD? 1** /* Quarries the 1st Slot Leading time pass/fail result, average, maximum and minimum values of transmission power. */
20. **TTL_MPTTRAIL? 1** /* Quarries the 1st Slot Trailing time pass/fail result, average, maximum and minimum values of transmission power. */

2.9. Narrowband Power vs Time Measurement

The Narrowband Power vs Time measurement measures the transmission power of setting period of Target signal for adjustment of transmitter of mobile station (MS).

The remote control measurement examples are as follows.

■ Programming example for remote control

1. Turn off the RF signal of the phone.
2. **CALLPROC OFF** /* Sets Call Processing OFF */
3. **ULFREQ 890.2MHz** /* Sets the UL Frequency 890.2 MHz */
4. **ILVL 27DBM** /* Sets Input Level 27 dBm */
5. **TX_TOMODE ON,20** /* Sets Timeout 20 s */
   ---Sets “NBANDPVT ON” only when execute first measurement of Narrowband Power vs Time measurement---
6. **NBANDPVT ON** /* Enables Narrowband Power vs Time measurement */
7. **NBANDPVT_SEG 1000,200** /* Sets Segment duration 1 ms, sets Number of segment 200 */
8. **NBANDPVT_MW 10,80** /* Sets Measurement window offset 10%, sets Measurement window 80% */
9. **SNGLS** /* Starts measurement */
10. Turn on the RF signal of the phone.
11. **SWP?** /* Queries whether or not the measurement has been completed. */
12. Repeat “SWP?” Query until “0” response.
13. **MSTAT?** /* Queries measurement status */
14. **NBANDPVT_POWER?** /* Queries measurement result of each segment */
    ---Following commands set at Narrowband Power vs Time measurement completion---
15. **NBANDPVT OFF** /* Disable Narrowband Power vs Time measurement */

3. CDMA2000 Measurement Software

3.1. Multi Power Measurement

Multi Power measurement is the function which measures the average power that the Mobile Station outputs a signal for tuning transmit power by single measurement. The Mobile Station is changed to the mode called test mode, and is performed measurement.

■ Programming example for remote control

1. **SCRSEL MPMEAS** /* Select Multi Power Measurement screen. */
2. **BANDCLASS 0** /* Set Band Class to 0. */
3. **CHAN 283** /* Set Channel to 283. */
4. **OEXTLOSS 0,0.20** /* Set loss value of Main Output. */
5. **IEXTLOSS 0,0.20** /* Set loss value of Main Input. */
6. **EXTLOSSW ON** /* Enable loss settings. */
7. **ARFLVL OFF** /* Set Input Level Set Mode to Manual. */
8. **ILVL 30.0** /* Set Input Level to 30.0 dBm. */
9. **MPMEAS_NUMSTEP 50** /* Set Number of Steps to 50. */
10. **MPMEAS_STEPTIME 20** /* Set Power Step Time to 20 ms. */
11. **MPMEAS_TIMEOUT 15** /* Set Timeout to 15 s. */
12. ***OPC?** /* Wait for setting completion. */
13. Repeat “*OPC?” Query until response is “1”.
14. **SNGLS** /* Start measurement. */
15. **MSTAT?** /* Queries measurement status. */
16. Wait until the MT8815B/MT8820B is ready for trigger detection.
17. Output signal to be measured from Mobile Station.
18. **SWP?** /* Wait for measurement completion. */
19. Repeat “SWP?” Query until response is “0”.
20. **MRFPWR? 0,50** /* Queries the measured results for 50 steps starting from Step 0. */

3.2. Tx/Rx vs. Frequency Measurement

Tx/Rx vs Frequency measurement is the function which calibrate simultaneously the transmit power and the received power of Mobile Station, changing frequency by single measurement.

■ Programming example for remote control

1. **SCRSEL MPMEAS** /* Select Multi Power Measurement screen. */
2. **BANDCLASS 0** /* Set Band Class to 0. */
3. **OEXTLOSS 0,0.25** /* Set loss value of Main Output. */
4. **IEXTLOSS 0,0.25** /* Set loss value of Main Input. */
5. **EXTLOSSW ON** /* Enable loss settings. */
6. **OLVL –20** /* Set Output Level to –20 dBm/1.23 MHz. */
7. **ARFLVL OFF** /* Set Input Level Set Mode to Manual. */
8. **ILVL 30.0** /* Set Input Level to 30.0 dBm. */
9. **LVLCONT ON** /* Set Level Continuous to On. */
10. **REGTX_RX_FREQ 869.25,924.25,845.25,900.25**
    /* Set Output Frequencies and Input Frequencies. */
11. **REGMRXPWR -20,-25,-30,-35,-40** /* Set Output Levels. */
12. **TX_RX_SEG_DURATION 10** /* Set Segment Length to 10ms. */
13. **TX_RX_TIMEOUT 15** /* Set Timeout to 15 s. */
14. ***OPC?** /* Wait for setting completion. */
15. Repeat “*OPC?” Query until response is “1”.
16. **SNGLSTX_RX_FREQ 6,2** /* Start measurement as the Number of Segments to 6 and the Number of Sequences to 2. */
17. **TX_RX_FREQ_READY?** /* Wait for trigger ready (response 1). */
18. Repeat “TX_RX_FREQ_READY?” Query until response is “1”.
19. Output signal to be measured from Mobile Station.
20. **SWP?** /* Wait for measurement completion (response 0). */
21. Repeat “SWP?” Query until response is “0”.
22. **TX_RX_FREQ?** /* Query the measured results. */

4. 1xEV-DO Measurement Software

4.1. Multi Power Measurement

Multi Power measurement is the function which measure the average power that the Access Terminal outputs a signal for tuning transmit power by single measurement.

■ Programming example

1. **SCRSEL MPMEAS** /* Select Multi Power Measurement screen. */
2. **BANDCLASS 0** /* Set Band Class to 0. */
3. **CHAN 283** /* Set Channel to 283. */
4. **OEXTLOSS 0,0.20** /* Set loss value of Main Output. */
5. **IEXTLOSS 0,0.20** /* Set loss value of Main Input. */
6. **EXTLOSSW ON** /* Enable loss settings. */
7. **ARFLVL OFF** /* Set Input Level Set Mode to Manual. */
8. **ILVL 30.0** /* Set Input Level to 30.0 dBm. */
9. **MPMEAS_NUMSTEP 50** /* Set Number of Steps to 50. */
10. **MPMEAS_STEPTIME 20** /* Set Power Step Time to 20 ms. */
11. **MPMEAS_TIMEOUT 15** /* Set Timeout to 15 s. */
12. ***OPC?** /* Wait for setting completion. */
13. Repeat “*OPC?” Query until response is “1”.
14. **SNGLS** /* Start measurement. */
15. **MSTAT?** /* Send a query and wait for a response. Wait until the MT8815B/MT8820B is ready for trigger detection.*/
16. Output signal to be measured from Access Terminal.
17. **SWP?** /* Wait for measurement completion. */
18. Repeat “SWP?” Query until response is “0”.
19. **MRFPWR? 0,50** /* Queries the measured results for 50 steps starting from Step 0. */

5. TD-SCDMA Measurement Software

5.1. Tx/Rx vs. Frequency Measurement

This function is used to measure the UE transmission power and at the same time it also controls the downlink(DL) signal generated by MT8815B/20B/20C according to the pre defined frequency and level sequences.

■ Programming example for MT8820C

```
    --- Common parameter settings ---
1.  CALLPROC OFF                    /* Sets Call Processing to OFF */
2.  MOD ON                          /* Sets Modulation to ON */
3.  DELLOSSTBL                      /* Resets cable loss table */
4.  LOSSTBLVAL 1800MHz,1.2,1.2,1.2
                                    /* cable loss = 1.2 dB at 1800 MHz */
5.  LOSSTBLVAL 1900MHz,1.1,1.1,1.1
                                    /* cable loss = 1.1 dB at 1900 MHz */
6.  LOSSTBLVAL 2000MHz,1.3,1.3,1.3
                                    /* cable loss = 1.3 dB at 2000 MHz */
7.  EXTLOSSW COMMON                 /* Cable loss compensation is set to common table */
8.  DLFREQ 2021.8MHz                /* Current DL frequency */
9.  ULFREQ 2015.2MHz                /* Current UL frequency */
    --- TXRX vs Frequency parameters settings ---
10. MEASOBJ TXRX                    /* Sets measurement object to TXRX vs Frequency */
11. TX_RX_SLOT 4,2                  /* 4slots for RX,2slots for TX */
12. TX_RX_FLT RRC                   /* Sets RRC filter for TX power measurement */
13. TX_RX_MW 0,100                  /* Measurement window in a slot */
14. TX_RX_TRG_LVL -30               /* Trigger threshold level */
15. TX_RX_TRG_TOUT 10               /* Trigger time out */
16. TX_RX_SEQ 8                     /* Number of sequences */
17. REGTX_RX_FREQ1 2021.8,2015.2,2013.0,2019.6,2017.4,1888.4,1913.2,1896.0,1884.2,1901.6,1892.2,1909.2,
    1896.0,2015.2,1900.0,2015.2     /* Frequencies for RX and TX */
    --- Measurement ---
18. TX_RX_SUBFRAME 21               /* Number of subframes in a sequence */
19. REGMTXREF ON,24.0,7,-12.0       /* Input level control in a sequence */
20. REGMRXPWR 0,-35.0,-35.0,-35.0,-35.0
                                    /* subframe #0, level for slot #3 to #6 */
21. REGMRXPWR 1,-35.0,-35.0,-35.0,-35.0
                                    /* subframe #1, level for slot #3 to #6 */
22. REGMRXPWR 2,-35.0,-35.0,-35.0,-35.0
                                    /* subframe #2, level for slot #3 to #6 */
23. REGMRXPWR 3,-48.0,-48.0,-48.0,-48.0
                                    /* subframe #3, level for slot #3 to #6 */
24. REGMRXPWR 4,-48.0,-48.0,-48.0,-48.0
                                    /* subframe #4, level for slot #3 to #6 */
25. REGMRXPWR 5,-48.0,-48.0,-48.0,-48.0
                                    /* subframe #5, level for slot #3 to #6 */
26. REGMRXPWR 6,-60.0,-60.0,-60.0,-60.0
                                    /* subframe #6, level for slot #3 to #6 */
27. REGMRXPWR 7,-60.0,-60.0,-60.0,-60.0
                                    /* subframe #7, level for slot #3 to #6 */
28. REGMRXPWR 8,-60.0,-60.0,-60.0,-60.0
                                    /* subframe #8, level for slot #3 to #6 */
29. REGMRXPWR 9,-69.0,-69.0,-69.0,-69.0
                                    /* subframe #9, level for slot #3 to #6 */
30. REGMRXPWR 10,-69.0,-69.0,-69.0,-69.0
                                    /* subframe #10, level for slot #3 to #6 */
```

31. **REGMRXPWR 11,-69.0,-69.0,-69.0,-69.0**
/* subframe #11, level for slot #3 to #6 */
32. **REGMRXPWR 12,-75.0,-75.0,-75.0,-75.0**
/* subframe #12, level for slot #3 to #6 */
33. **REGMRXPWR 13,-75.0,-75.0,-75.0,-75.0**
/* subframe #13, level for slot #3 to #6 */
34. **REGMRXPWR 14,-75.0,-75.0,-75.0,-75.0**
/* subframe #14, level for slot #3 to #6 */
35. **REGMRXPWR 15,-83.0,-83.0,-83.0,-83.0**
/* subframe #15, level for slot #3 to #6 */
36. **REGMRXPWR 16,-83.0,-83.0,-83.0,-83.0**
/* subframe #16, level for slot #3 to #6 */
37. **REGMRXPWR 17,-83.0,-83.0,-83.0,-83.0**
/* subframe #17, level for slot #3 to #6 */
38. **REGMRXPWR 18,-90.0,-90.0,-90.0,-90.0**
/* subframe #18, level for slot #3 to #6 */
39. **REGMRXPWR 19,-90.0,-90.0,-90.0,-90.0**
/* subframe #19, level for slot #3 to #6 */
40. **REGMRXPWR 20,-90.0,-90.0,-90.0,-90.0**
/* subframe #20, level for slot #3 to #6 */
41. **ILVL +24dBm** /* max nominal input level expected for UE TX power(H1) */
42. **OLVL -33dBm** /* max output level for each sequences*/
43. ***OPC?** /* Wait for setting completion. */
44. --- repeat "*OPC?" until "1" is responded ---
45. **SNGLS** /* Executes single measurement */
46. ***OPC?** /* Wait for setting completion. */
47. --- repeat "*OPC?" until "1" is responded ---
--- UE starts synchronization with DwPCH and outputs Uplink signal at this point ---
---Measurement status .integrity and TX power result ---
48. **MSTAT?** /* Queries measurement status. */
49. --- repeat "MSTAT?" until "0" is responded ---
50. **TX_RX_STAT?** /* Queries for measurement status */
51. **TX_RX_FREQ? 0** /* Queries for TX power result of sequence #0 */
52. **TX_RX_FREQ? 1** /* Queries for TX power result of sequence #1 */
53. **TX_RX_FREQ? 2** /* Queries for TX power result of sequence #2 */
54. **TX_RX_FREQ? 3** /* Queries for TX power result of sequence #3 */
55. **TX_RX_FREQ? 4** /* Queries for TX power result of sequence #4 */
56. **TX_RX_FREQ? 5** /* Queries for TX power result of sequence #5 */
57. **TX_RX_FREQ? 6** /* Queries for TX power result of sequence #6 */
58. **TX_RX_FREQ? 7** /* Queries for TX power result of sequence #7 */

■ Programming example for MT8815/20B

--- Common parameter settings ---

1. **CALLPROC OFF** /* Sets Call Processing to OFF. */
2. **LVLCONT OFF** /* Sets Level Continuous to OFF. */
3. **MOD ON** /* Sets Modulation to ON. */
4. **DELLOSSTBL** /* Resets cable loss table. */
5. **LOSSTBLVAL 1800MHz,1.2,1.2,1.2**
   /* cable loss = 1.2 dB at 1800 MHz. */
6. **LOSSTBLVAL 1900MHz,1.1,1.1,1.1**
   /* cable loss = 1.1 dB at 1900 MHz. */
7. **LOSSTBLVAL 2000MHz,1.3,1.3,1.3**
   /* cable loss = 1.3 dB at 2000 MHz. */
8. **EXTLOSSW COMMON** /* Cable loss compensation is set to common table. */
9. **DLFREQ 2021.8MHz** /* Current DL frequency. */
10. **ULFREQ 2015.2MHz** /* Current UL frequency. */

--- TXRX vs Frequency parameters settings ---

11. **MEASOBJ TXRX** /* Sets measurement object to TXRX vs Frequency. */
12. **TX_RX_SLOT 4,2** /* 4slots for RX,2slots for TX. */
13. **TX_RX_FLT RRC** /* Sets RRC filter for TX power measurement. */
14. **TX_RX_MW 0,100** /* Measurement window in a slot. */
15. **TX_RX_TRG_LVL -30** /* Trigger threshold level. */
16. **TX_RX_TRG_TOUT 10** /* Trigger time out. */
17. **TX_RX_SEQ 8** /* Number of sequences. */
18. **REGTX_RX_FREQ1 2021.8,2015.2,2013.0,2019.6,2017.4,1888.4,1913.2,1896.0,1884.2,1901.6,1892.2,1909.2, 1896.0,2015.2,1900.0,2015.2** /* Frequencies for RX and TX. */

--- 1st measurement ---

19. **TX_RX_SUBFRAME 9** /* Number of subframes in a sequence. */
20. **REGMRXPWR 0,-35.0,-35.0,-35.0,-35.0**
    /* subframe #0, level for slot #3 to #6 */
21. **REGMRXPWR 1,-35.0,-35.0,-35.0,-35.0**
    /* subframe #1, level for slot #3 to #6 */
22. **REGMRXPWR 2,-35.0,-35.0,-35.0,-35.0**
    /* subframe #2, level for slot #3 to #6 */
23. **REGMRXPWR 3,-48.0,-48.0,-48.0,-48.0**
    /* subframe #3, level for slot #3 to #6 */
24. **REGMRXPWR 4,-48.0,-48.0,-48.0,-48.0**
    /* subframe #4, level for slot #3 to #6 */
25. **REGMRXPWR 5,-48.0,-48.0,-48.0,-48.0**
    /* subframe #5, level for slot #3 to #6 */
26. **REGMRXPWR 6,-60.0,-60.0,-60.0,-60.0**
    /* subframe #6, level for slot #3 to #6 */
27. **REGMRXPWR 7,-60.0,-60.0,-60.0,-60.0**
    /* subframe #7, level for slot #3 to #6 */
28. **REGMRXPWR 8,-60.0,-60.0,-60.0,-60.0**
    /* subframe #8, level for slot #3 to #6 */
29. **ILVL +24dBm** /* max nominal input level expected for UE TX power(H1) */
30. **OLVL -33dBm** /* max output level for each sequences */
31. **LVLCONT ON** /* Sets Level continuous to ON. */
32. ***OPC?** /* Wait for setting completion. */
33. Repeat “*OPC?” until “1” is responded.
34. **SNGLS** /* Executes single measurement */
35. ***OPC?** /* Wait for setting completion. */

36. Repeat “*OPC?” until “1” is responded.
    --- UE starts synchronization with DwPCH and outputs Uplink signal at this point ---
    ---Measurement status .integrity and TX power result ---
37. **MSTAT?** /* Queries measurement status. */
38. --- repeat “MSTAT?” until “0” is responded ---
39. **TX_RX_STAT?** /* Queries for measurement status */
40. **TX_RX_FREQ? 0** /* Queries for TX power result of sequence #0 */
41. **TX_RX_FREQ? 1** /* Queries for TX power result of sequence #1 */
42. **TX_RX_FREQ? 2** /* Queries for TX power result of sequence #2 */
43. **TX_RX_FREQ? 3** /* Queries for TX power result of sequence #3 */
44. **TX_RX_FREQ? 4** /* Queries for TX power result of sequence #4 */
45. **TX_RX_FREQ? 5** /* Queries for TX power result of sequence #5 */
46. **TX_RX_FREQ? 6** /* Queries for TX power result of sequence #6 */
47. **TX_RX_FREQ? 7** /* Queries for TX power result of sequence #7 */
48. **LVLCONT OFF** /* Sets Level continuous to OFF */
    --- 2nd measurement ---
49. **TX_RX_SUBFRAME 12** /* Number of subframes in a sequence */
50. **REGMRXPWR 0,-69.0,-69.0,-69.0,-69.0**
    /* subframe #0, level for slot #3 to #6 */
51. **REGMRXPWR 1,-69.0,-69.0,-69.0,-69.0**
    /* subframe #1, level for slot #3 to #6 */
52. **REGMRXPWR 2,-69.0,-69.0,-69.0,-69.0**
    /* subframe #2, level for slot #3 to #6 */
53. **REGMRXPWR 3,-75.0,-75.0,-75.0,-75.0**
    /* subframe #3, level for slot #3 to #6 */
54. **REGMRXPWR 4,-75.0,-75.0,-75.0,-75.0**
    /* subframe #4, level for slot #3 to #6 */
55. **REGMRXPWR 5,-75.0,-75.0,-75.0,-75.0**
    /* subframe #5, level for slot #3 to #6 */
56. **REGMRXPWR 6,-83.0,-83.0,-83.0,-83.0**
    /* subframe #6, level for slot #3 to #6 */
57. **REGMRXPWR 7,-83.0,-83.0,-83.0,-83.0**
    /* subframe #7, level for slot #3 to #6 */
58. **REGMRXPWR 8,-83.0,-83.0,-83.0,-83.0**
    /* subframe #8, level for slot #3 to #6 */
59. **REGMRXPWR 9,-90.0,-90.0,-90.0,-90.0**
    /* subframe #9, level for slot #3 to #6 */
60. **REGMRXPWR 10,-90.0,-90.0,-90.0,-90.0**
    /* subframe #10, level for slot #3 to #6 */
61. **REGMRXPWR 11,-90.0,-90.0,-90.0,-90.0**
    /* subframe #11, level for slot #3 to #6 */
62. **ILVL -12dBm** /* max nominal input level expected for UE TX power (L1) */
63. **OLVL -67dBm** /* max output level for each sequences */
64. **LVLCONT ON** /* Sets level continuous to ON. */
65. ***OPC?** /* Wait for setting completion. */
66. Repeat “*OPC?” until “1” is responded.
67. **SNGLS** /* Executes single measurement* /
68. ***OPC?** /* Wait for setting completion. */
69. --- Repeat “*OPC?” until “1” is responded ---
    --- UE starts synchronization with DwPCH and outputs Uplink signal at this point ---
    --- Measurement status .integrity and TX power result ---
70. **MSTAT?** /* Queries measurement status. */
71. --- Repeat “MSTAT?” until “0” is responded ---
72. **TX_RX_STAT?** /* Queries for measurement status */
73. **TX_RX_FREQ? 0** /* Queries for TX power result of sequence #0 */
74. **TX_RX_FREQ? 1** /* Queries for TX power result of sequence #1 */
75. **TX_RX_FREQ? 2** /* Queries for TX power result of sequence #2 */
76. **TX_RX_FREQ? 3** /* Queries for TX power result of sequence #3 */

77. **TX_RX_FREQ? 4** /* Queries for TX power result of sequence #4 */
78. **TX_RX_FREQ? 5** /* Queries for TX power result of sequence #5 */
79. **TX_RX_FREQ? 6** /* Queries for TX power result of sequence #6 */
80. **TX_RX_FREQ? 7** /* Queries for TX power result of sequence #7 */
81. **LVLCONT OFF** /* Sets Level Continuous to OFF. */

5.2. Tx/Rx vs. Frequency Measurement (Continuous)

The TXRX vs Frequency Measurement (Continuous) is used to measure the average power of the UE for adjusting and confirming the transmission power and reception gain.

■ Programming example for TX measurement

---Common parameter setting---

1. **CALLPROC OFF** /* Sets Call Processing to Off. */
2. **MOD OFF** /* Sets Modulation to Off. */
3. **OLVL –70.0** /* Sets Output Level to –70.0 dBm. */
4. **ILVL 0.0** /* Sets Input Level to 0.0 dBm. */
5. **LVLCONT ON** /* Sets Level Continuous to On. However, this setting is not necessary for the MT8820C/21C.*/

---TXRX vs Frequency (Continuous) parameter setting---

6. **MEASOBJ TXRX_CONT** /* Sets the Measurement Object to TXRX vs Frequency (Continuous). */
7. **REGTX_RX_FREQ 2110,1920,2170,1980** /* Sets output frequency of sequence 0, input frequency of sequence 0, output frequency of sequence 1 and input frequency of sequence 1 to 2110 MHz, 1920 MHz, 2170 MHz and 1980 MHz. */
8. **REGMRXPWR –70,-70,-70,-70,-70** /* Sets output level of segment 0 to segment 4 to –70 dBm. */
9. **TX_RX_SEG_DURATION 10** /* Sets the segment length to 10 ms. */
10. **TX_RX_MW 10,80** /* Sets the offset of the measurement enable interval to 10 % and the ratio of measurement interval to 80%. */

---Start measurement---

11. **SNGLSTX_RX_FREQ 6,2** /* Starts measurement as the number of segments to 6 and the number of sequences to 2. */
12. **TX_RX_FREQ_READY?** /* Queries the ready status of TXRX vs. Frequency Measurement (Continuous) */
13. Repeat “TX_RX_FREQ_READY?” until “1” is responded.
14. Output signal to be measured from UE.
15. **SWP?** /* Queries whether or not the measurement has been completed */
16. Repeat “SWP?” until “0” is responded.
17. **MSTAT?** /* Queries the status of TXRX vs. Frequency Measurement (Continuous) */
18. **TX_RX_FREQ?** /* Queries the measured results */

■ Programming example for RX measurement

---Common parameter setting---

1. **CALLPROC OFF** /* Sets Call Processing to Off */
2. **MOD OFF** /* Sets Modulation to Off */
3. **OLVL -10** /* Sets Output Level to –10.0 dBm */
4. **ILVL 0.0** /* Sets Input Level to 0.0 dBm */
5. **LVLCONT ON** /* Sets Level Continuous to On. However, this setting is not necessary for the MT8820C/21C.*/

---TXRX vs Frequency (Continuous) parameter setting---

6. **MEASOBJ TXRX_CONT** /* Sets the Measurement Object to TXRX vs Frequency (Continuous) */
7. **REGTX_RX_FREQ 2110,1920,2170,1980**
   /* Sets output frequency of sequence 0, input frequency of sequence 0, output frequency of sequence 1 and input frequency of sequence 1 to 2110 MHz, 1920 MHz, 2170 MHz and 1980 MHz */
8. **REGMRXPWR –10,-11,-12,-13,-14**
   /* Sets output level of segment 0 to –10dBm, segment 1 to -11dBm, segment 2 to –12dBm, segment 3 to -13dBm, and segment 4 to –14 dBm */
9. **TX_RX_SEG_DURATION 10** /* Sets the segment length to 10 ms. */
10. **TX_RX_MW 10,80** /* Sets the offset of measurement window to 10 % and the measurement interval to 80%. */

---Start measurement---

11. **SNGLSTX_RX_FREQ 6,2** /* Starts measurement as the number of segments to 6 and the number of sequences to 2 */
12. **TX_RX_FREQ_READY?** /* Queries the ready status of TXRX vs. Frequency Measurement (Continuous)*/
13. Repeat “TX_RX_FREQ_READY?” until “1” is responded.
14. Output trigger signal from UE.
15. **SWP?** /* Queries whether or not the measurement has been completed */
16. Repeat “SWP?” until “0” is responded.
17. **MSTAT?** /* Queries the status of TXRX vs. Frequency Measurement (Continuous) */
18. **TX_RX_FREQ?** /* Queries the measured results */

Note:
When Level continuous is set to ON, since Output level is restricted to 30 dB, an error sometimes occurs at measurement. Accordingly, before executing LVLCONT ON, set Output level to the maximum output level set at REGMRXPWR. In addition, it is better to set to the DL frequency giving the maximum External Loss (DL Main) before executing LVLCONT ON when there is an External Loss setting.

5.3. Multi Power Measurement

The Multi Power Measurement is used to measure the average power of each step by outputting a step-shape signal from the UE for adjusting and confirming the transmission power.

■ Programming example for remote control

1. **ULFREQ 1980MHZ** /* Sets Uplink frequency to 1980 MHz */
2. **ILVL 0.0** /* Sets Input Level to 0.0 dBm */
3. **MPMEAS_NUMSTEP 50** /* Sets Number of Step to 50 */
4. **MPMEAS_STEPTIME 10** /* Sets Power Step Time to 10 ms */
5. **MPMEAS_TIMEOUT 15** /* Sets trigger detection timeout to 15 s */
6. **MPMEAS_MW 10,80** /* Sets the offset of the measurement enable interval to 10% and the measurement interval rate to 80%. */
7. **MEASOBJ MPMEAS** /* Sets Measurement Object to Multi Power Measurement */
   ---Start measurement---
8. **SWPMPMEAS** /* Starts measurement */
9. Output signal to be measured from UE.
10. **MRFPWR? 0,50** /* Queries the measured results for 50 steps starting from Step 0 */

6. LTE Measurement Software

6.1. Tx/Rx vs. Frequency Measurement

The Tx/Rx vs. Frequency Measurement is used to measure the average power of the UE for adjusting and confirming the transmission power and reception gain.

■Programming example for remote control

1. **SCRSEL FMEAS** /* Selects Fundamental Measurement screen. */
2. **CALLPROC OFF** /* Sets Call Processing to Off. */
3. **OLVL –80.0** /* Sets Output Level to – 80 dBm. */
4. **ILVL 20.0** /* Sets Input Level to 20.0 dBm. */
5. **REGTX_RX_FREQ 2110,1920,2170,1980**
   /* Sets sequence 0 output frequency to 2110 MHz, and input frequency to 1920 MHz. */
   /* Sets sequence 1 output frequency to 2170 MHz, and input frequency to 1980 MHz. */
6. **REGMRXPWR –80,-85,-85,-90,-90**
   /* Sets segment 0 output level to –80 dBm and segment 1 and 2 output levels to –85 dBm and segment 3 and 4 output levels to –90 dBm. */
7. **TX_RX_SEG_DURATION 10** /* Sets segment length to 10 ms. */
8. **TX_RX_MW 10,80** /* Sets offset of measurement enable interval to 10% and rate of measurement interval to 80%. */

   ---Starting measurement---
9. **SNGLSTX_RX_FREQ 6,2** /* Starts measurement using segment 6 and sequence 2. */
10. **TX_RX_FREQ_READY?** /* Queries measurement readiness. */
11. Repeats “TX_RX_FREQ_READY?” until response is “1”.
12. Signal to measure output from UE.
13. **SWP?** /* Queries measurement end. */
14. Repeats “SWP?” until the response returns to “0”.
15. **MSTAT?** /* Queries measurement end status. */
16. **TX_RX_FREQ_NUM?** /* Queries measurement results. */
    /* Result of query is 10,6,2 */
17. **TX_RX_FREQ?** /* Queries measurement results. */

6.2. Multi Power Measurement

The Multi Power Measurement is used to measure the average power of each step by outputting a step-shape signal from the UE for adjusting and confirming the transmit power.

■Programming example for remote control

1. **SCRSEL FMEAS** /* Selects Fundamental Measurement screen. */
2. **ULCHAN 9750** /* Sets Channel to 9750. */
3. **ILVL 20.0** /* Sets Input Level to 20.0 dBm. */
4. **MPMEAS_NUMSTEP 50** /* Sets Number of Step to 50. */
5. **MPMEAS_STEPTIME 10** /* Sets Power Step Time to 10 ms. */
6. **MPMEAS_TIMEOUT 15** /* Sets timeout of trigger detection to 15 s. */
7. **MPMEAS_MW 10,80** /* Sets offset of measurement enable interval to 10%. */
   /* Sets rate of measurement interval to 80 %. */

   ---Starting Measurement---
8. **SWPMPMEAS** /* Starts measurement in synchronized single mode. */
9. Outputting signal from UE.
10. **MRFPWR? 0,50** /* Query result from Step 0 to 50. */

To perform the measurement in single mode, carry out the following steps instead of steps 8-10.

   ---Starting Measurement---
8. **SNGLSMPMEAS** /* Starts measurement in single mode. */
9. **MPMEAS_READY?** /* Queries measurement readiness. */
10. Repeats “MPMEAS_READY?” until response is “1”.
11. Signal to measure output from UE.
12. **MRFPWR? 0,50** /* Query result from Step 0 to 50. */

6.3. Narrowband Power vs.Time Measurement

The Narrowband Power vs. Time measurement performs the transmission power of setting period of Target signal for adjustment of transmitter of mobile station (MS).

■Programming example for remote control

1. Stop UE signal output.
2. **CALLPROC OFF** /* Sets call processing to Off. */
3. **ULFREQ 890.2MHZ** /* Sets UL frequency to 890.2 MHz */
4. **ILVL 27DBM** /* Sets Input Level to 27 dBm */
5. **NBANDPVT_TIMEOUT 20** /* Sets timeout to 20 s */

   ---Set “NBANDPVT ON” below only at first Narrowband Power vs. Time measurement---
6. **NBANDPVT ON** /* Enables Narrowband Power vs. Time measurement */
7. **NBANDPVT_SEG 1000,200** /* Sets segment length to 1 ms and number of segments to 200 */
8. **NBANDPVT_MW 10,80** /* Sets offset of measurement window to 10 % and measurement window to 80 % */
9. **SNGLS** /* Measures */
10. Outputting signal from UE.
11. **SWP?** /* Queries measurement end. */
12. Repeats “SWP?” until response is “0”.
13. **MSTAT?** /* Queries measurement status. */
14. **NBANDPVT_POWER?** /* Queries transmission power for each measurement segment */
15. ---Set “NBANDPVT OFF” below only when Narrowband Power vs. Time measurement finished---
16. **NBANDPVT OFF** /* Disables Narrowband Power vs. Time measurement. */

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