Discover What's Possible™ Anritsu

APPLICATION NOTE

MT8820A

Radio Communication Analyzer

W-CDMA/GSM

ANRITSU CORPORATION

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1. W-CDMA Measurement Software

1.1. Specification

Table 1.1-1 W-CDMA Measurement Software Specification

Item	Specification
Modulation analysis	Frequency: 300~2200 MHz Input level: −30~+35 dBm(Main) Carrier frequency accuracy: Reference oscillator accuracy+10 Hz Modulation accuracy(Residual vector error): ≤2.5%(when inputting one DPCCH and one DPDCH.)
RF power	Frequency: 300~2200 MHz Input level: −65~+35 dBm(Main) Measurement accuracy: ±0.5 dB(−25~+35 dBm), ±0.7 dB(−55~−25 dBm), ±0.9 dB(−65~−55 dBm), after calibration Linearity: ±0.2 dB(0~−40 dB, ≥−55 dBm), ±0.4 dB(0~−40 dB, ≥−65 dBm) Measurement object: DPCH, PRACH
Occupied bandwidth	Frequency: 300~2200 MHz Input level: −10~+35 dBm(Main)
Adjacent channel power	Frequency: 300~2200 MHz Input level: −10~+35 dBm(Main) Measurement points: ±5 MHz, ±10 MHz Measurement range: ≥50 dB(at ±5 MHz), ≥55 dB(at ±10 MHz)
RF signal generator	Output frequency: 300~2200 MHz Channel level(CPICH, P-CCPCH, SCH, PICH, DPCH, S-CCPCH, AICH): Off, −30.0~0.0 dB[0.1 dB step, relative level to Ior(total level)] Channel level(OCNS): Off, automatic setting Channel level accuracy: ±0.2 dB(relative level acuuracy to Ior(total level)) AWGN level: Off, −20~+5 dB(0.1 dB step) AWGN level accuracy: ±0.2 dB(relative level accuracy to Ior(total level))
Error rate measurement	Function: Insert PN9 or PN15 pattern in DTCH. Measurement items: BER, BLER BER measurement object: Loopback data inserted in the uplink DTCH, serial data inputted from the call processing I/O port on a rear panel. BLER measurement object: Loopback data inserted in the uplink DTCH
Call processing	Call control: Location registration, origination, termination, handover, disconnection from network, disconnection from UE (executes each processing in conformity with 3GPP standards and performs the pass/fail evaluation) UE control: Output level, loopback (controls each UE in conformity with 3GPP standards)

1.2. 3GPP Measurement Specification Table

TS34.121	Item	comment	
5	**Transmitter Characteristics**		
5.2	Maximum Output Power		√√
5.3	Frequency Error		√√
5.4	**Output Power Dynamics in the Uplink**		
5.4.1	Open Loop Power Control in the Uplink		√√
5.4.2	Inner Loop Power Control in the Uplink		√√
5.4.3	Minimum Output Power		√√
5.4.4	Out-of-synchronisation handling of output power		√√
5.5	Transmit ON/OFF Power		√√
5.6	Change of TFC		√√
5.7	Power setting in uplink compressed mode		–
5.8	Occupied Bandwidth (OBW)		√√
5.9	Spectrum Emission Mask		√√
5.10	Adjacent Channel Leakage Power		√√
5.11	Spurious Emissions	Requires SPA	√
5.12	Transmit Intermodulation	Requires SG and SPA	√
5.13	**Transmit Modulation**		
5.13.1	Error Vector Magnitude (EVM)		√√
5.13.2	Peak code domain error	Single Code Only	√√
5.13.3	UE phase discontinuity		√√
5.13.4	PRACH preamble quality		√√
6	**Receiver Characteristics**		
6.2	Reference Sensitivity Level		√√
6.3	Maximum Input Level		√√
6.4	Adjacent Channel Selectivity (ACS)	Requires SG	√
6.5	Blocking Characteristics	Requires SG	√
6.6	Spurious Response	Requires SG	√
6.7	Intermodulation Characteristics	Requires SG	√
6.8	Spurious Emissions	Requires SPA	√

√√: Support | √: Requires external equipment (SPA or SG) | F: Future Support | –: Not Support

TS34.121	Item	comment	
7	**Performance requirements**		
7.2	Demodulation in Static Propagation conditions		√√
7.3	Demodulation of DCH in Multi-path Fading Propagation conditions	Requires Fading Simulator	√
7.4	Demodulation of DCH in Moving Propagation conditions	Requires Fading Simulator	√
7.5	Demodulation of DCH in Birth-Death Propagation conditions	Requires Fading Simulator	√
7.6	Demodulation of DCH in downlink Transmit diversity modes		–
7.7	Demodulation in Handover conditions		–
7.8	Power control in downlink		–
7.9	Downlink compressed mode		–
7.10	Blind Transport format detection		–
7.11	Demodulation of Paging Channel (PCH)		–
7.12	Detection of Acquisition Indicator (AI)		–

√√: Support | √: Requires external equipment (SPA or SG) | F: Future Support | –: Not Support

1.3. TRX Measurement (Fundamental Measurement)

The description of measurement procedures in/after this paragraph assumes that the control software is created by GPIB. Refer to the operation manual for details of GPIB commands and manual operations. GPIB commands are written in red.

Connection in Test Loop Mode

Measurement is performed by connecting an UE in Test Loop Mode1. The connection procedures are below.

1. Execute **PRESET_3GPP** and set the default parameter for 3GPP.
2. Execute **INTEGRITY ON** and set Integrity Protection to On.
3. Execute **DRXCYCLNG 64** and set DRX Cycle Length to 64Frame(=640ms).
4. Turn on the power of an UE.
5. Execute **CALLSTAT?** and wait for the response to turn 2(=Idle(Regist)).
6. Execute **CALLSA** and connect in Test Loop Mode1.
7. Execute **CALLSTAT?** and wait for the response to turn 7(=Test Loop Mode).

Disconnection in Test Loop Mode

1. Execute **CALLSO** and connect to Test Loop Mode1.
2. Execute **CALLSTAT?** and wait for the response to turn 2(=Idle(Regist)).

Channel Switching by Handover

Measurement is normally performed at three frequency points; L,M and H. Handover enables to perform high-speed channel switching without the need of reconnection. Output Level must be set a little higher when performing handover so that it won't fail. Also, the GPIB commands, which are transmitted during handover, stand by until the handover ends.

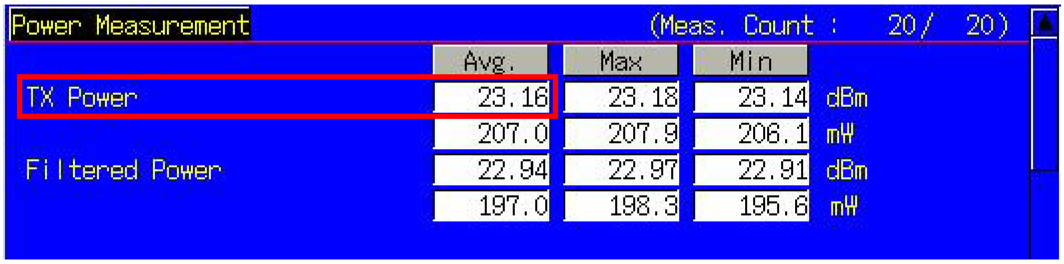
1. Execute TRX measurement at M channel.
2. Execute **CHAN 9613** and hand over to L channel.
3. Execute TRX measurement.
4. Execute **CHAN 9887** and hand over to H channel.
5. Execute TRX measurement.

Selection of Test Items

All items are set to On in the default setting of MT8820A. In order to reduce measurement time, BER and BLER measurements that are unnecessary items should be set to Off (**BER_MEAS OFF**, **BLER_MEAS OFF**) before measurement.

5.2 Maximum Output Power

1. Connect to Test Loop Mode1.
2. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
3. Execute **OLVL -106** and set Output Level to –106dBm.
4. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
5. Execute **PWR_MEAS ON** and set Power Measurement to On.
6. Execute **PWR_AVG 20** and set the average count of power measurement to 20 times.
7. Execute **SWP** and perform power measurement.
8. Execute **AVG_POWER?** and read the result of power measurement.



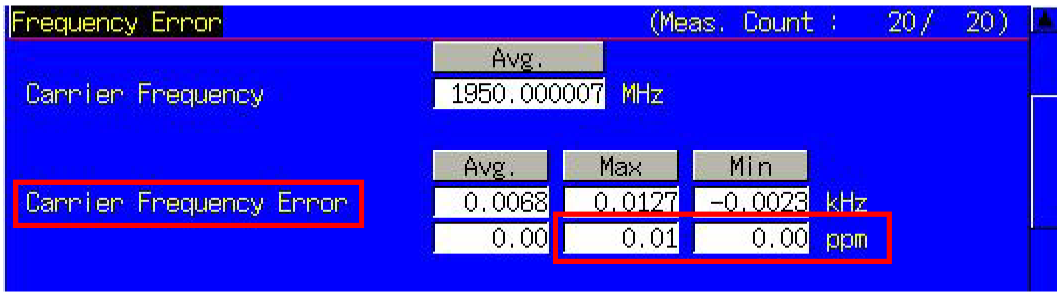
TX Power corresponds to Mean power (5MHz band), and Filtered Power corresponds to RRC filtered mean power.

5.3 Frequency Error

Avg. measurement result is the average value of signed measurement results. Max and Min results must be used.

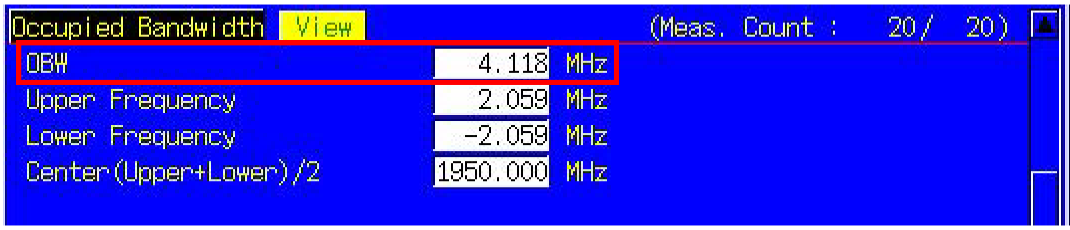
1. Connect to Test Loop Mode1.
2. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
3. Execute **OLVL -106** and set Output Level to –106dBm.
4. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
5. Execute **FREQ_MEAS ON** and set Frequency Measurement to On.
6. Execute **FREQ_AVG 20** and set the average count of frequency measurement to 20 times.
7. Execute **SWP** and perform frequency measurement.
8. Execute **MAX_CARRFERR? PPM** and read the result of frequency error measurement.
9. Execute **MIN_CARRFERR? PPM** and read the result of frequency error measurement.

Max and Min results must be used for signed measurements such as Frequency Error.



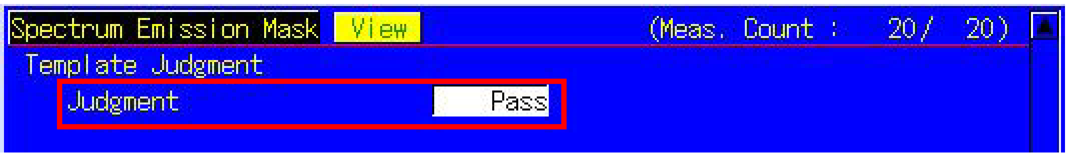
5.8 Occupied Bandwidth

1. Connect to Test Loop Mode1.
2. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
3. Execute **OLVL -106** and set Output Level to –106dBm.
4. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
5. Execute **OBW_MEAS ON** and set OBW Measurement to On.
6. Execute **OBW_AVG 20** and set the average count of OBW measurement to 20 times.
7. Execute **SWP** and perform OBW measurement.
8. Execute **OBW?** and read the result of OBW measurement.



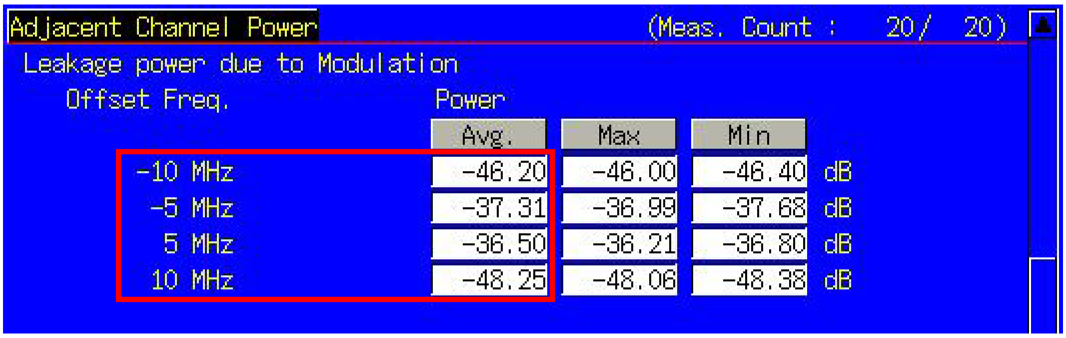
5.9 Spectrum Emission Mask

1. Connect to Test Loop Mode1.
2. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
3. Execute **OLVL -106** and set Output Level to –106dBm.
4. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
5. Execute **SMASK_MEAS ON** and set SEM Measurement to On.
6. Execute **SMASK_AVG 20** and set the average count of SEM measurement to 20 times.
7. Execute **SWP** and perform SEM measurement.
8. Execute **SMASKPASS?** and read the judgment result of SEM measurement.



5.10 Adjacent Channel Leakage Power

1. Connect to Test Loop Mode1.
2. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
3. Execute **OLVL -106** and set Output Level to –106dBm.
4. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
5. Execute **ADJ_MEAS ON** and set ACLR Measurement to On.
6. Execute **ADJ_AVG 20** and set the average count of ACLR measurement to 20 times.
7. Execute **SWP** and perform ACLR measurement.
8. Execute **AVG_MODPWR? LOW10, AVG_MODPWR? LOW5, AVG_MODPWR? UP5, AVG_MODPWR? UP10** and read the result of ACLR measurement.



Adjacent Channel Power (Meas. Count : 20/ 20)

Leakage power due to Modulation

Offset Freq.	Power Avg.	Max	Min	
-10 MHz	-46.20	-46.00	-46.40	dB
-5 MHz	-37.31	-36.99	-37.68	dB
5 MHz	-36.50	-36.21	-36.80	dB
10 MHz	-48.25	-48.06	-48.38	dB

5.13.1 Error Vector Magnitude (EVM)

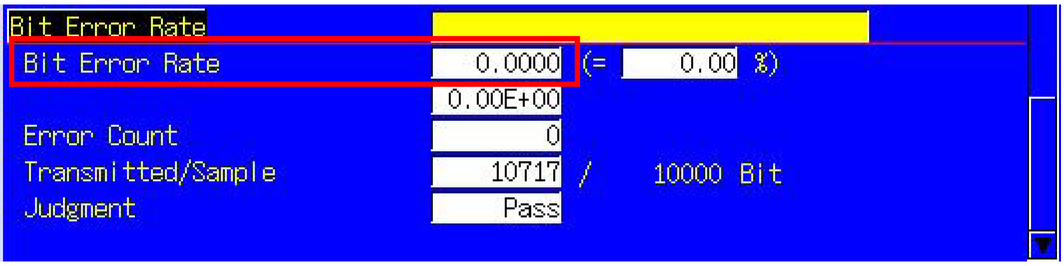
1. Connect to Test Loop Mode1.
2. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
3. Execute **OLVL -106** and set Output Level to –106dBm.
4. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
5. Execute **INC_ORGNOFS ON** and set Origin Offset to be included in EVM measurement.
6. Execute **MOD_MEAS ON** and set Modulation Analysis Measurement to On.
7. Execute **MOD_AVG 20** and set the average count of modulation analysis to 20 times.
8. Execute **SWP** and perform modulation analysis measurement.
9. Execute **AVG_EVM?** and read the result of EVM measurement.
10. Execute **TOCALGO 2** and set TPC Algorithm to 2.
11. Execute **TPCPAT ILPC** and set TPC Pattern to Inner Loop Power Control.
12. Execute **ILVL -20.0** and set Input Level to –20.0dBm.
13. Wait about 200mm seconds until the UE power gets –20.0dBm.
14. Esecute **TPCPAT ALT** and set TPC Pattern to Alternate.
15. Repeat the procedure, 8.9 above descrubed.

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

	Avg.	Max	Min	
Error Vector Magnitude	7.31	7.44	7.13	%(rms)
Peak Vector Error	17.34	18.51	15.87	%
Phase Error	3.14	3.23	3.02	deg.(rms)
Magnitude Error	4.83	4.88	4.76	%(rms)
Origin Offset	-25.78	-25.52	-26.10	dB
IQ Imbalance	102.75	103.51	101.99	%(I/Q)
Timing Error	0.4	0.5	0.3	chip
DPCCH/DPDCH Power Ratio	-5.48	-5.44	-5.51	dB

6.2 Reference Sensitivity Level

1. Connect to Test Loop Mode1.
2. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
3. Execute **OLVL -106** and set Output Level to –106dBm.
4. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
5. Execute **BER_MEAS ON** and set BER Measurement to On.
6. Execute **BER_SAMPLE 10000** and set the number of BER measurement samples to 10000 bits.
7. Execute **SWP** and perform BER measurement.
8. Execute **BER?** and read the result of BER measurement.



Reduction of measurement time by batch processing

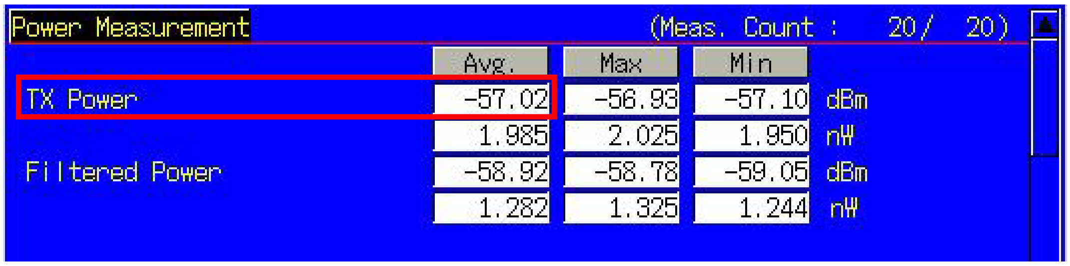
Above TRX test items can be measured under the same measurement parameter. Measurement time can be reduced by batch processing of all items.

1. Connect to Test Loop Mode1.
2. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
3. Execute **OLVL -106** and set Output Level to –06dBm.
4. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
5. Execute **INC_ORGNOFS ON** and set Origin Offset to be included in EVM measurement.
6. Execute **ALLMEASITEMS ON,20,ON,20,ON,20,ON,20,ON,20,ON,20,OFF,1,ON,OFF**.
   Set the test items except Code Domain Power and BLER to On, and Average Count to 20 times.
7. Execute **BER_SAMPLE 10000** and set the number of BER measurement samples to 10000 bits.
8. Execute **SWP** and perform the measurement.
9. Execute **AVG_POWER?**,etc. and read the measurement result.

5.4.3 Minimum Output Power

Minimum Output Power can be measured in accordance with the measurement of STEP E and G of Inner Loop Power Control in the Uplink. The following describes the measuring method on the Fundamental Measurement screen.

1. Execute **SCRSEL FMEAS** and display the Fundamental Measurement screen.
2. Execute **ILVL -20.0** and set Input Level to –20.0dBm.
3. Execute **OLVL -93.0** and set Output Level to –93.0dBm.
4. Execute **TPCPAT ALL0** and set TPC Pattern to ALL0.
5. Execute **PWR_MEAS ON** and set Power Measurement to On.
6. Execute **PWR_AVG 20** and set the average count of power measurement to 20 times.
7. Execute **SWP** and perform the measurement.
8. Execute **AVG_POWER?** and read the result of power measurement.



1.4. Open Loop Power Control Measurement

RACH with Time Mask measurement on the Time Domain Measurement screen is used for the following measurements.

On the Time Domain Measurement screen,
RRC Filter Off (TDM_RRC OFF) corresponds to Mean power (5MHz band),
RRC Filter On (TDM_RRC ON) corresponds to RRC filtered mean power.

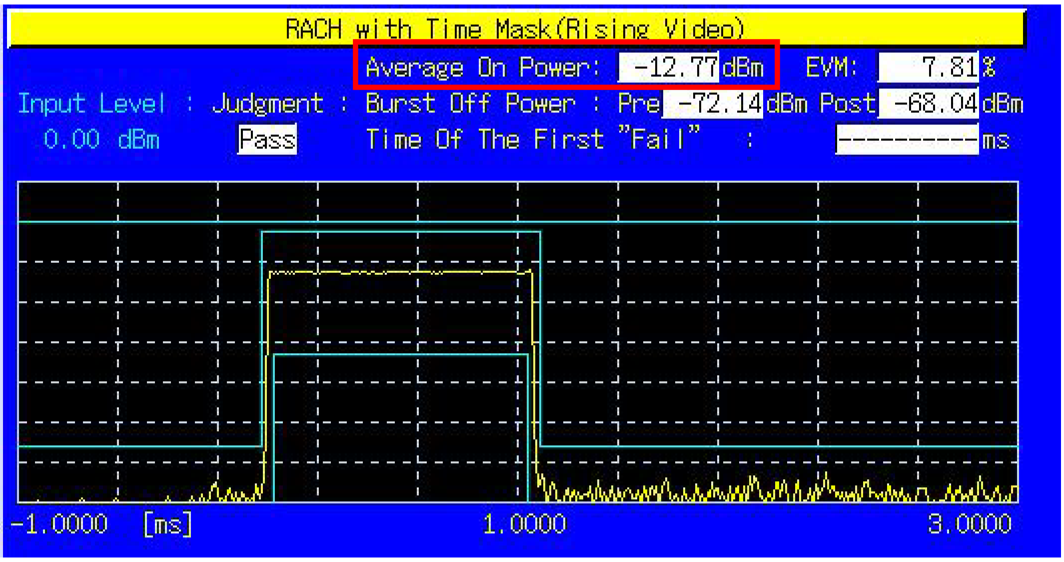
1. Execute **SCRSEL TDMEAS** and display the Time Domain Measurement screen.
2. Execute **MEASOBJ RACHTMSK** and set Measurement Object to RACH with Time Mask.
3. Execute **TIMSPAN 4.0MS** and set Time Span of Time Domain measurement to 4.0ms.
4. Execute **TRGDELAY -1.0MS** and set Trigger Delay of Time Domain measurement to –1.0ms.
5. Execute **MAXULPWR 24.0** and set Maximum Allowed UL TX Power to 24.0dBm
6. Execute **RABCONNECT OFF** and set RAB connection to Off.

Maximum Allowed TX Power is the basic parameter for Cell Selection and Reselection on UE. In order to enable UE to perform Cell Selection and Reselection, it should be set the value under the maximum power on the UE power class. For example, when UE Power Class = 3, MAXULPWR should be set 24.0.

By setting RAB connection to off, the call status can be returned to Idle without connecting RAB on Test Loop Mode. So, measurement speed can be faster by that.

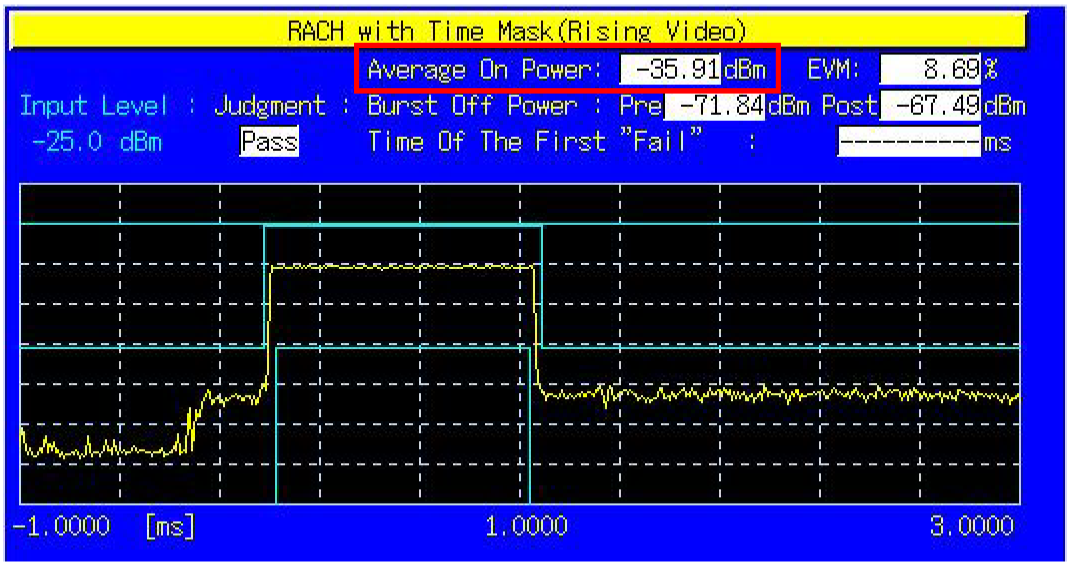
5.4.1 Open Loop Power Control in the Uplink (RX-middle)

1. Execute **OLVL -65.7** and set Output Level to –65.7dBm.
2. Execute **ILVL 0.0** and set Input Level to 0.0dBm.
3. Execute **CPICHTXPWR 28** and set Primary CPICH DL TX Power to +28dBm.
4. Execute **INTERFERENCE -101** and set UL Interference to –101dBm.
5. Execute **CONSTANT -10** and set Constant Value to –10dB.
6. Execute **TDM_RRC OFF** and set RRC Filter to Off.
7. Turn on the power of an UE and perform Registration.
8. Execute **SWPANDPG** and perform RACH measurement in Test Loop Mode.
9. Execute **RACHPWR_AVG?** and read the result of power measurement for RACH.



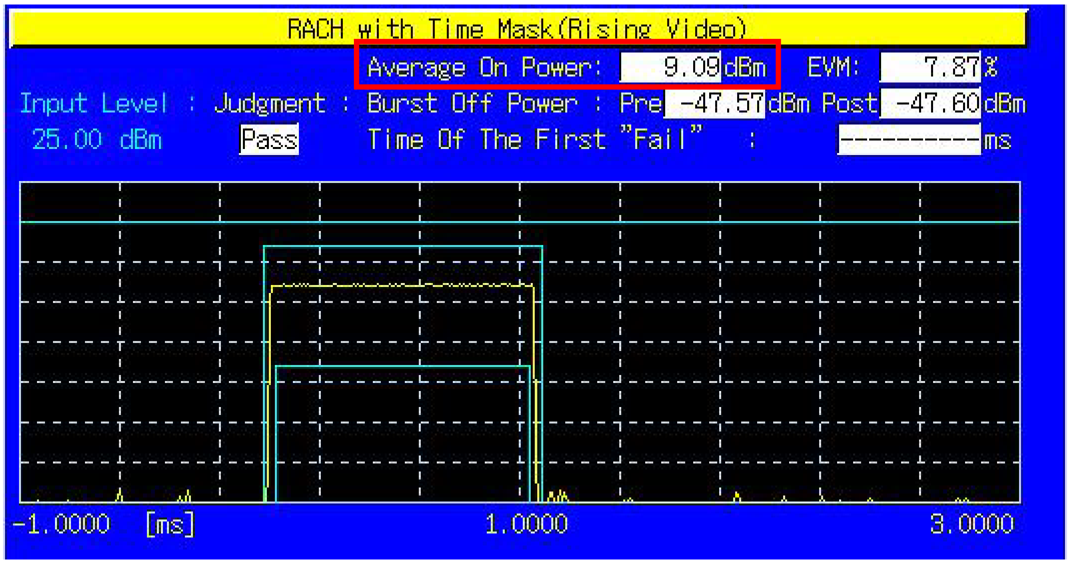
5.4.1 Open Loop Power Control in the Uplink (RX Upper dynamic end)

1. Execute **OLVL -25.0** and set Output Level to –25.0dBm.
2. Execute **ILVL -25.0** and set Input Level to –25.0dBm.
3. Execute **CPICHTXPWR 19** and set Primary CPICH DL TX Power to +19dBm.
4. Execute **INTERFERENCE -75** and set UL Interference to –75dBm.
5. Execute **CONSTANT -10** and set Constant Value to –10dB.
6. Execute **TDM_RRC OFF** and set RRC Filter to Off.
7. Turn on the power of an UE and perform Registration.
8. Execute **SWPANDPG** and perform RACH measurement in Test Loop Mode.
9. Execute **RACHPWR_AVG?** and read the result of power measurement for RACH.



5.4.1 Open Loop Power Control in the Uplink (RX-Sensitivity level)

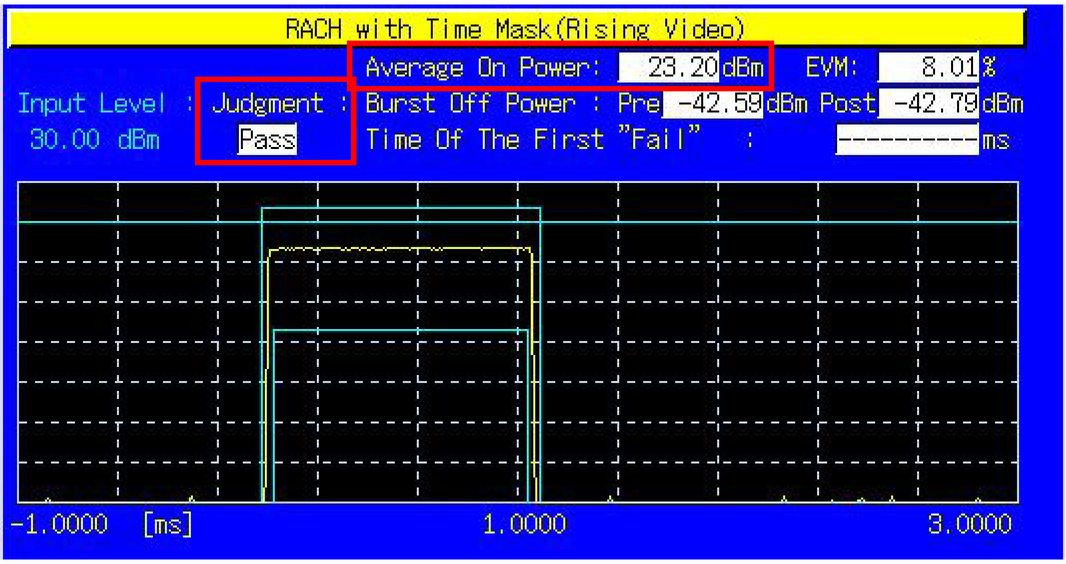
1. Execute **OLVL -65.7** and set Output Level to –65.7dBm.
2. Execute **ILVL 25.0** and set Input Level to +25.0dBm.
3. Execute **CPICHTXPWR 19** and set Primary CPICH DL TX Power to +19dBm.
4. Execute **INTERFERENCE -110** and set UL Interference to –110dBm.
5. Execute **CONSTANT -10** and set Constant Value to –10dB.
6. Execute **TDM_RRC OFF** and set RRC Filter to Off.
7. Turn on the power of an UE and perform Registration.
8. Execute **OLVL -106.7** and set Output Level to –106.7dBm.
9. Execute **SWPANDPG** and perform RACH measurement in Test Loop Mode.
10. Execute **RACHPWR_AVG?** and read the result of power measurement for RACH.



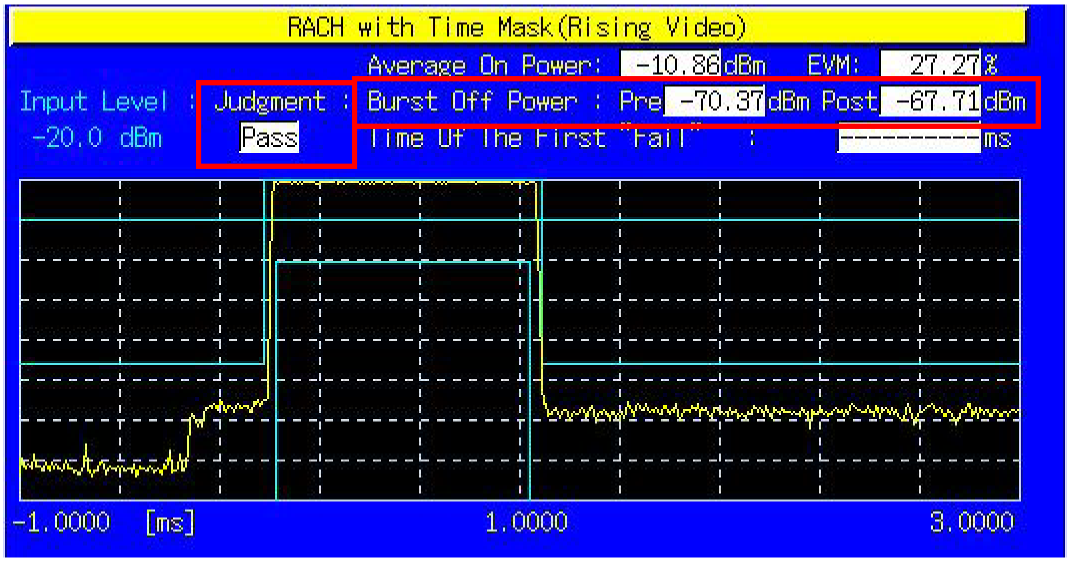
5.5 Transmit ON/OFF Power

Due to the restriction of MT8820A's dynamic range (40dB), it is impossible to measure On Power and Off Power simultaneously. Measurement must be performed twice after changing Input Level. The following describes the measurement example of Power Class3 UE.

1. Execute **OLVL -65.7** and set Output Level to –65.7dBm.
2. Execute **ILVL 30.0** and set Input Level to +30.0dBm.
3. Execute **CPICHTXPWR 19** and set Primary CPICH DL TX Power to +19dBm.
4. Execute **INTERFERENCE -95** and set UL Interference to –95dBm.
5. Execute **CONSTANT -10** and set Constant Value to –10dB.
6. Execute **TEMPPOS ON** and set Template judgment area to On area only.
7. Execute **TDM_RRC OFF** and set RRC Filter to Off.
8. Turn on the power of an UE and perform Registration.
9. Execute **OLVL -106.7** and set Output Level to –106.7dBm.
10. Execute **SWPANDPG** and perform RACH measurement in Test Loop Mode.
11. Execute **RACHPWR_AVG?** and read the result of power measurement for RACH.
12. Execute **RACHPASS?** and read the template judgment result for RACH.



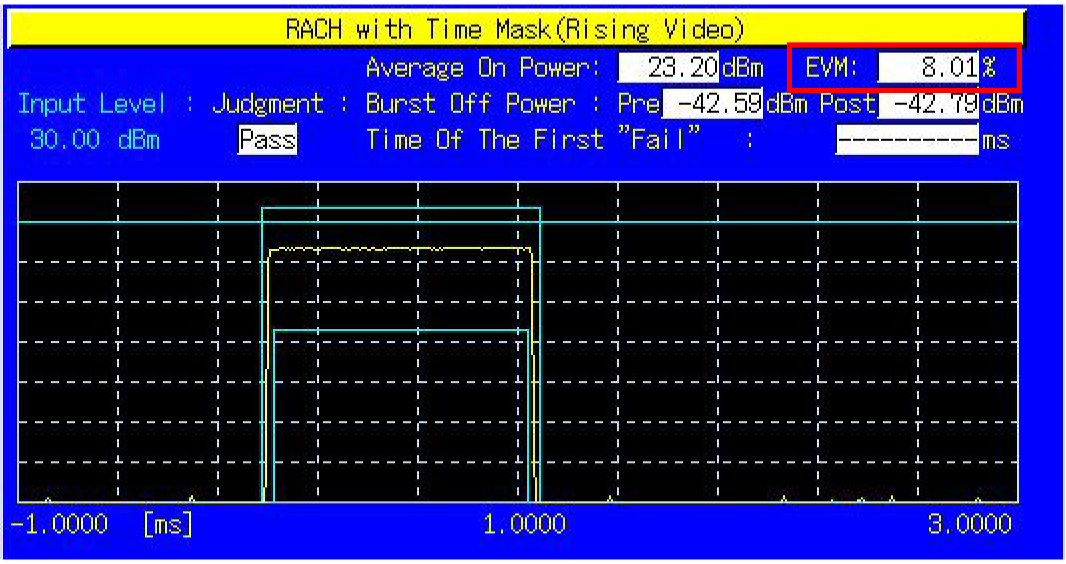
13. Disconnect from Test Loop Mode.
14. Execute **ILVL -20.0** and set Input Level to –20.0dBm.
15. Execute **TEMPPOS OFF** and set Template judgment area to Off area only.
16. Execute **TDM_RRC ON** and set RRC Filter to On.
17. Execute **SWPANDPG** and perform RACH measurement in Test Loop Mode.
18. Execute **RACHOFFPWR_AVG?** and read the result of Off Power measurement for RACH.
19. Execute **RACHPASS?** and read the Template judgment result for RACH.



5.13.4 PRACH preamble quality

Although it is impossible to specify RACH Sub Channel and PRACH Signature, EVM and Frequency Error for RACH can be measured. The following describes the measurement example of Power Class3 UE.

1. Execute **OLVL -101.7** and set Output Level to –101.7dBm.
2. Execute **ILVL 30.0** and set Input Level to +30.0dBm.
3. Execute **CPICHTXPWR 24** and set Primary CPICH DL TX Power to +24dBm.
4. Execute **INTERFERENCE -95** and set UL Interference to –95dBm.
5. Execute **CONSTANT -10** and set Constant Value to –10dB.
6. Turn on the power of an UE and perform Registration.
7. Execute **SWPANDPG** and perform RACH measurement in Test Loop Mode.
8. Execute **RACHEVM?** and read the result of EVM measurement for RACH.
9. Execute **RACHFERR? PPM** and read the result of Frequency Error measurement for RACH.



Continuous measurement of Open Loop Power Control

Primary CPICH DL TX Power, UL Interference and Constant Value are changed before Open Loop Power Control measurement. These are parameters of broadcast information and the changed parameters are not immediately reflected to the UE side. In order to perform Open Loop Power Control measurement continuously, the parameters must be reflected to the UE by any of the following methods.

1)Wait 5 seconds(approx.) after changing parameters. (MT8820A transmits BCCH modification info to an UE with PAGING TYPE1 message when changing parameters above. Actually, however, it takes approx. 5 seconds to reflect the changed parameters to the UE.)

2)Turn on the power of the UE again after changing paramters and wait for the UE to perform Registration.

3)Change LAC parameter as well as above parameters and wait for the UE to perform Registration.

In this case, by executing **DRXCYCLNG 64** and setting DRX Cycle Length to the minimum value, 64Frame(=640ms), the UE is instantaneously informed that broadcast information is modified.

1.5. Inner Loop Power Control Measurement

Inner Loop Power Control measurement on the Time Domain Measurement screen is used for the following measurements. Due to the restriction of MT8820A's dynamic range (40dB), it is impossible to measure Test Step E,F,G and H at a time. Measurement must be performed twice after changing Input Level.

1. Execute **SCRSEL TDMEAS** and display the Time Domain Measurement screen.
2. Execute **MEASOBJ ILPC** and set Measurement Object to Inner Loop Power Control.
3. Execute **SLOTLIST ON** and display a slot list.
4. Execute **REGSLOTLIST 0-59** and register Slot0~Slot59 for the slot list.
5. Execute **TIMSPAN 40.0MS** and set Time Span of Time Domain measurement to 40.0ms.
6. Execute **TPCALGO 2** and set TPC Algorithm to 2.
7. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
8. Execute **TDM_RRC OFF** and set RRC Filter to Off.
9. Connect to Test Loop Mode1.

Inner Loop Power Control parameter

Inner Loop Power Control Parameter of Call Processing Paramter is the setting of TPC command in the static state. When Power Control Bit Pattern is set to Inner Loop Power Control, TPC command is transmitted automatically so that the output power of an UE turns the specified Input Level.

On the one hand, Inner Loop Power Control Parameter of Time Domain Parameter sets the TPC command transmitted between Slot 0 and the specified Slot only when Measurement Object of Time Domain Measurement is set to Inner Loop Power Control. The TPC command specified in Call Processing Parameter is transmitted after transmitting only for the specified number of slots in the measurement.

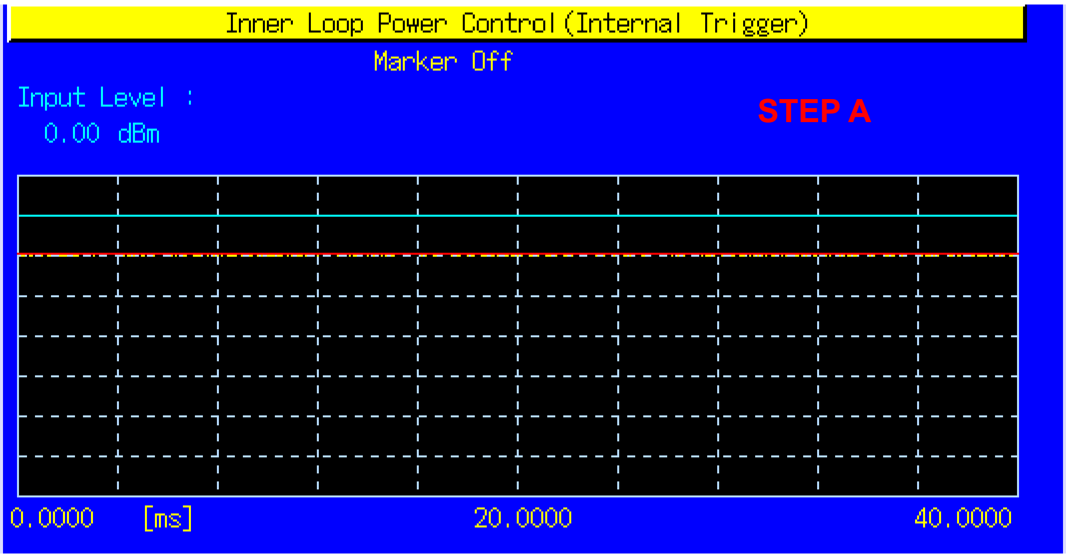
In some cases, several dBs lower/higher value from Input Level is required for UE output power before starting Inner Loop Power Control measurement. For example, the following steps must be performed to set Input Level to +30dBm and UE output power to –10dBm.

1. Execute **TPCPAT ILPC** and set TPC Pattern to Inner Loop Power Control.
2. Execute **ILVL -10.0** and set Input Level to –10.0dBm.
3. Wait for the power of an UE to turn –10.0dBm.
4. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
5. Execute **ILVL 30.0** and set Input Level to +30.0dBm.

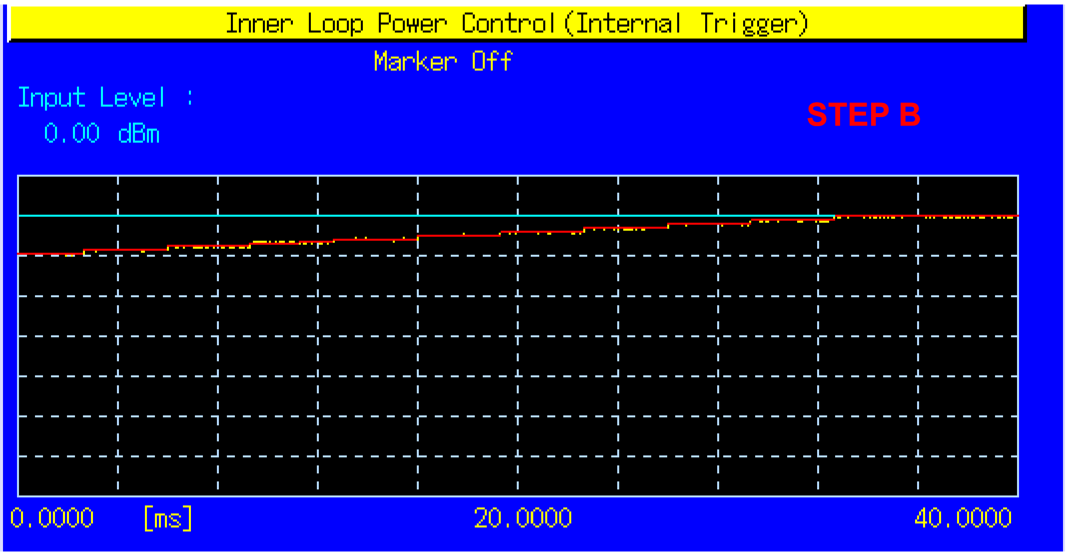
Function		Command	Query	Response	Remarks
Call Processing Parameter - Inner Loop Power Control					
Power Control Algorithm	Algorithm 1	TPCALGO 1	TPCALGO?	1	
	Algorithm 2	TPCALGO 2		2	
TPC Step Size	1 dB	TPCSTEP 1	TPCSTEP?	1	
	2 dB	TPCSTEP 2		2	
Power Control Bit Pattern	All 0	TPCPAT ALL0	TPCPAT?	ALL0	
	All 1	TPCPAT ALL1		ALL1	
	Alternate	TPCPAT ALT		ALT	
	Inner Loop Power Control	TPCPAT ILPC		ILPC	
Time Domain Paramter - Inner Loop Power Control					
ILPC TPC Method	Step A	ILP_TPC A	ILP_TPC?	A	
	...	...		...	
	Step H	ILP_TPC H		H	
ILPC TPC Command Slot Length		ILP_CMDSLOT method,length	ILP_CMDSLOT? method	length	method = B~H length = 1~450 slot

5.4.2 Inner Loop Power Control in the Uplink

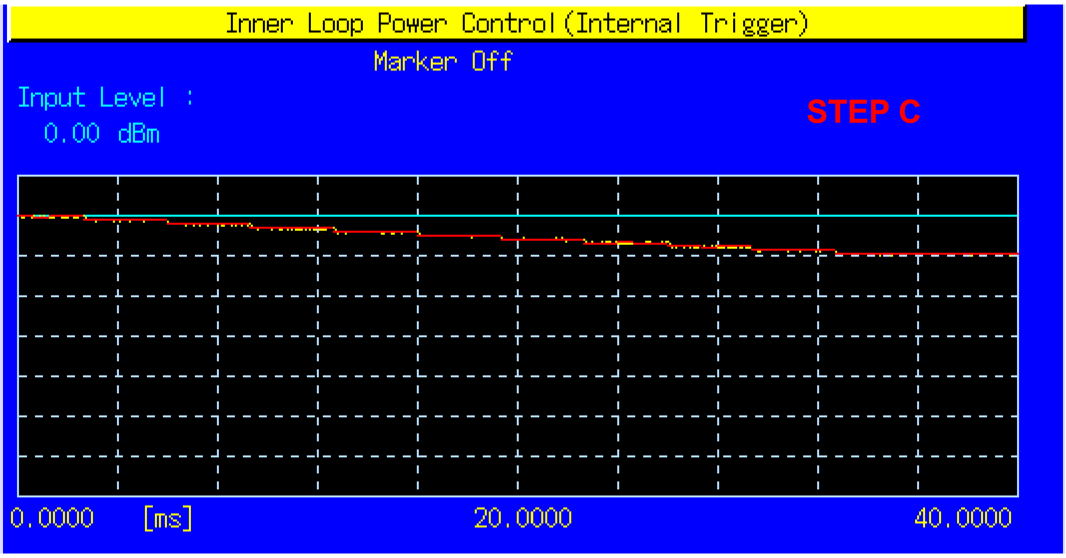
1. Execute **ILP_TPC A** and set TPC Test Step to A.
2. Execute **TPCALGO 2** and set TPC Algorithm to 2.
3. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
4. Execute **TPCPAT ILPC** and set TPC Pattern to Inner Loop Power Control.
5. Execute **ILVL -10.0** and set Input Level to –10.0dBm.
6. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
7. Execute **ILVL 0.0** and set Input Level to 0.0dBm.
8. Execute **SWP** and perform the measurement.
9. Execute **SLOT_PWR? ALL** and read the measurement result.



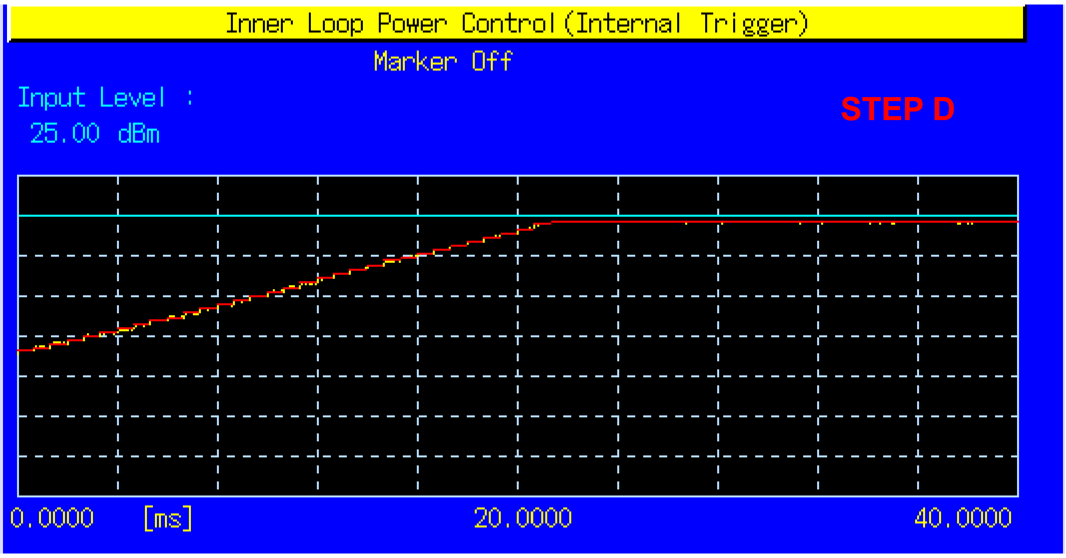
[Step B]
10. Execute **ILP_TPC B** and set TPC Test Step to B.
11. Execute **TPCALGO 2** and set TPC Algorithm to 2.
12. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
13. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
14. Execute **ILVL 0.0** and set Input Level to 0.0dBm.
15. Execute **SWP** and perform the measurement.
16. Execute **SLOT_PWR? ALL** and read the measurement result.



[Step C]
17. Execute **ILP_TPC C** and set TPC Test Step to C.
18. Execute **TPCALGO 2** and set TPC Algorithm to 2.
19. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
20. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
21. Execute **ILVL 0.0** and set Input Level to 0.0dBm.
22. Execute **SWP** and perform the measurement.
23. Execute **SLOT_PWR? ALL** and read the measurement result.

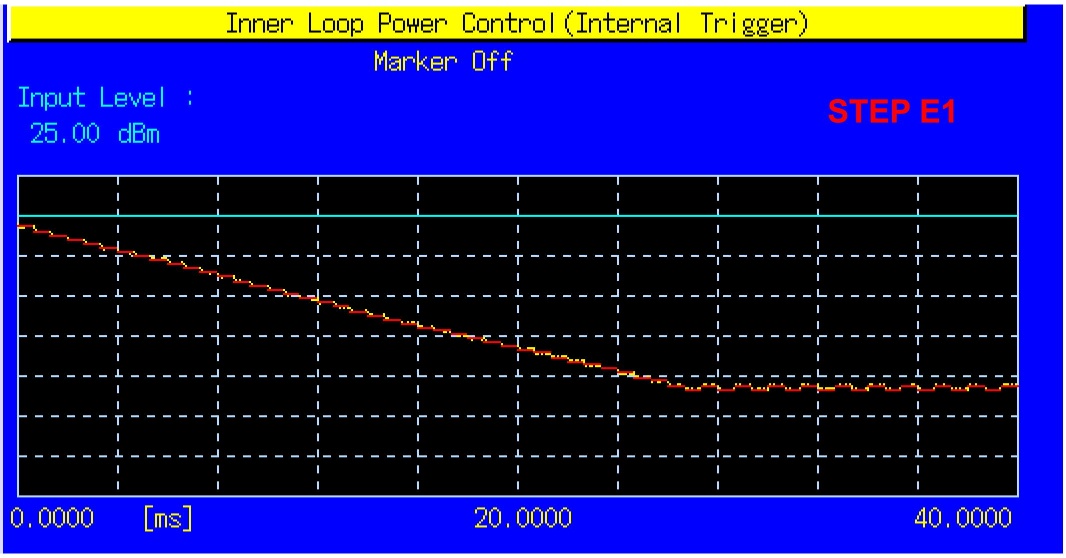


[Step D]
24. Execute **ILP_TPC D** and set TPC Test Step to D.
25. Execute **TPCALGO 1** and set TPC Algorithm to 1.
26. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
27. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
28. Execute **ILVL 25.0** and set Input Level to +25.0dBm.
29. Execute **SWP** and perform the measurement.
30. Execute **SLOT_PWR? ALL** and read the measurement result.



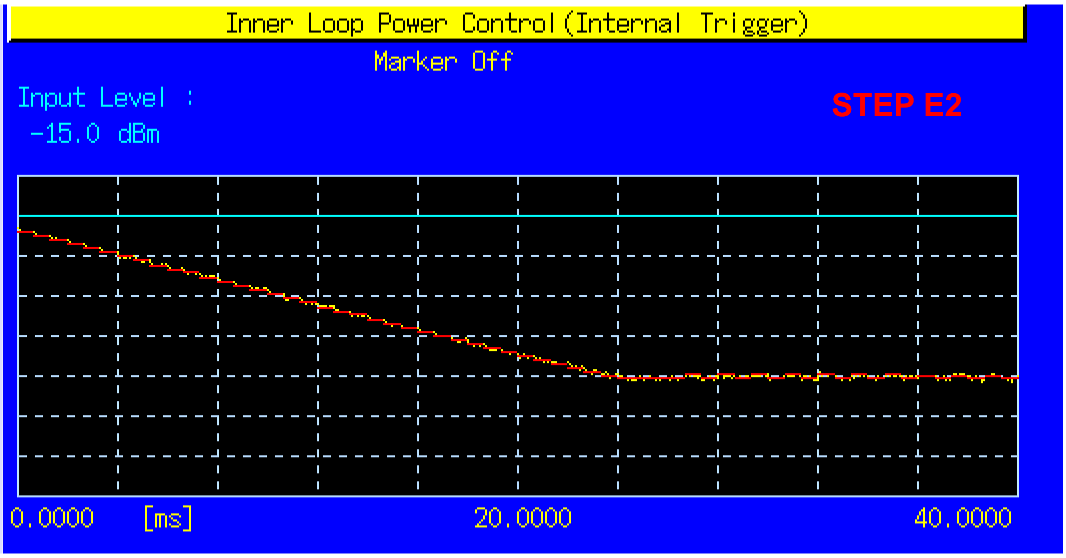
[Step E 1]

31. Execute **ILP_TPC E** and set TPC Test Step to E.
32. Execute **ILP_CMDSLOT E,40** and set the number of slots in Test Step E to 40.
33. Execute **TPCALGO 1** and set TPC Algorithm to 1.
34. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
35. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
36. Execute **ILVL 25.0** and set Input Level to +25.0dBm.
37. Execute **SWP** and perform the measurement.
38. Execute **SLOT_PWR? ALL** and read the measurement result.

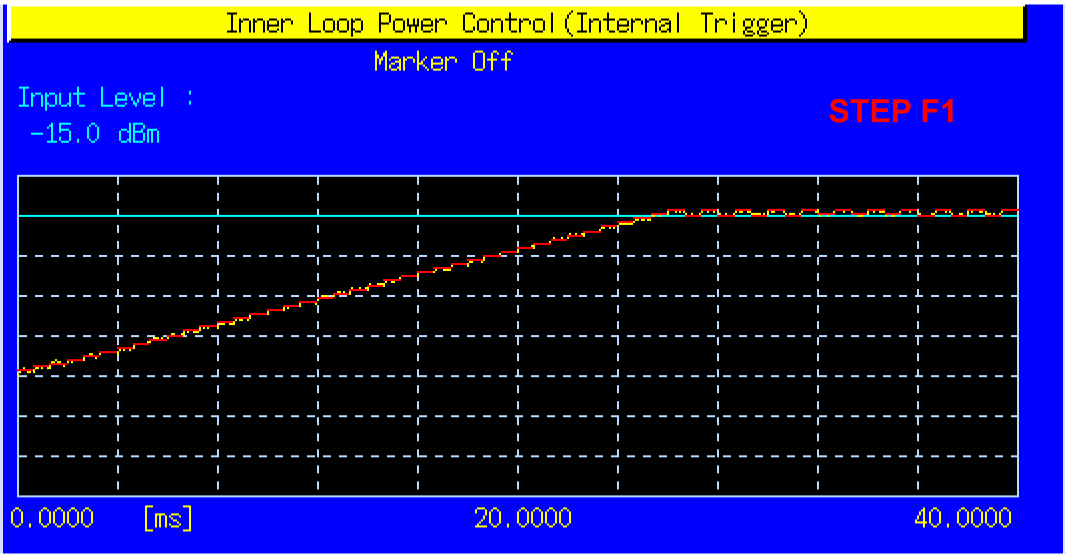


[Step E 2]

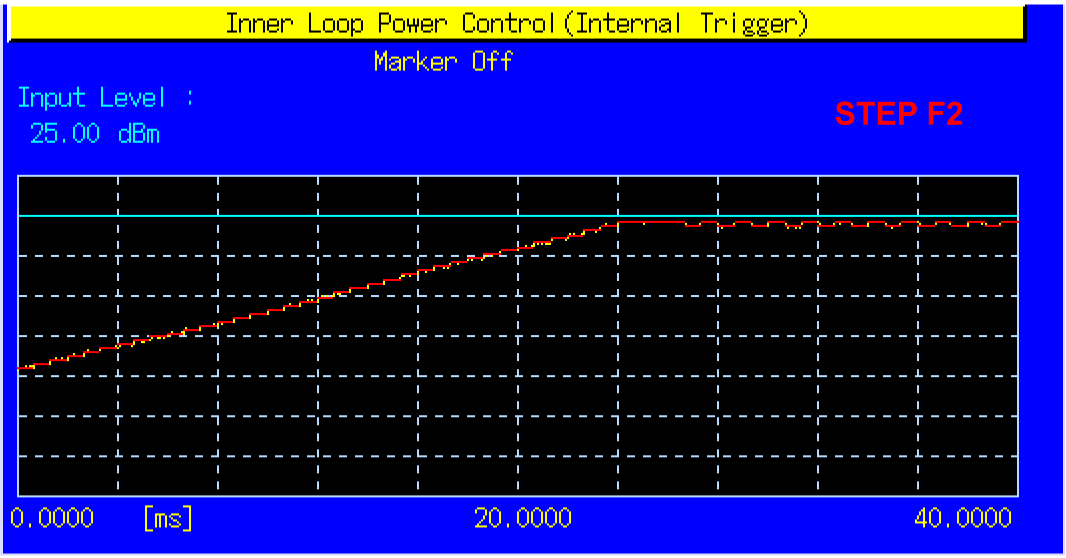
39. Execute **ILP_TPC E** and set TPC Test Step to E.
40. Execute **ILP_CMDSLOT E,40** and set the number of slots in Test Step E to 40.
41. Execute **TPCALGO 1** and set TPC Algorithm to 1.
42. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
43. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
44. Execute **ILVL -15.0** and set Input Level to –15.0dBm.
45. Execute **SWP** and perform the measurement.
46. Execute **SLOT_PWR? ALL** and read the measurement result.



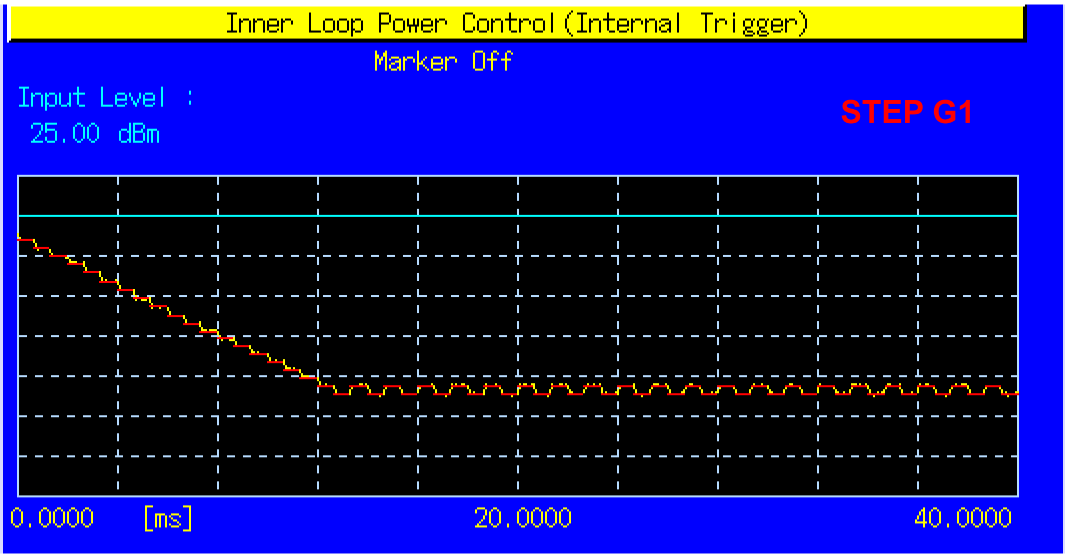
[Step F 1]
47. Execute **ILP_TPC F** and set TPC Test Step to F.
48. Execute **ILP_CMDSLOT F,40** and set the number of slots in Test Step F to 40.
49. Execute **TPCALGO 1** and set TPC Algorithm to 1.
50. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
51. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
52. Execute **ILVL -15.0** and set Input Level to –15.0dBm.
53. Execute **SWP** and perform the measurement.
54. Execute **SLOT_PWR? ALL** and read the measurement result.



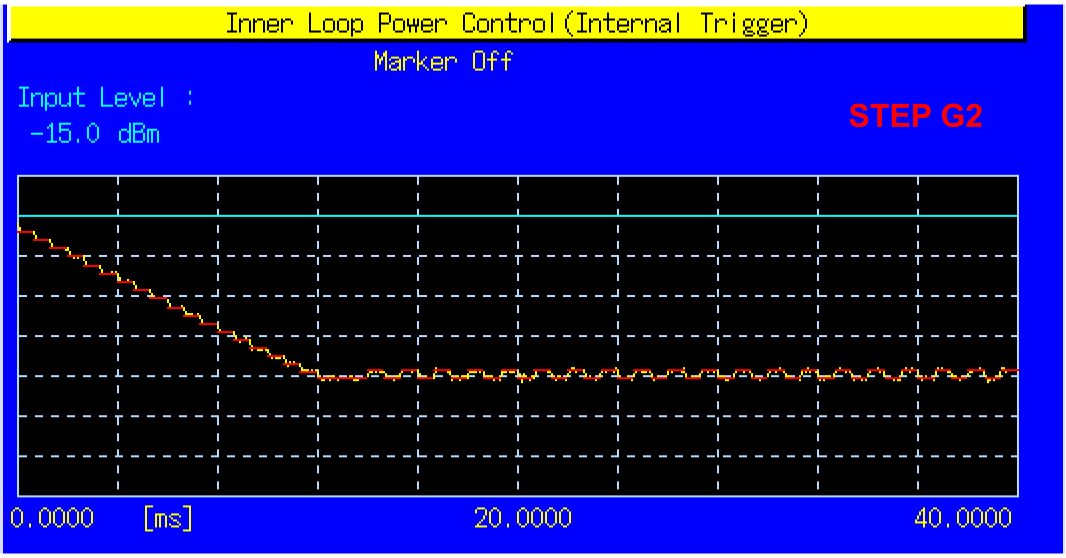
[Step F 2]
55. Execute **ILP_TPC F** and set TPC Test Step to F.
56. Execute **ILP_CMDSLOT F,40** and set the number of slots in Test Step F to 40.
57. Execute **TPCALGO 1** and set TPC Algorithm to 1.
58. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
59. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
60. Execute **ILVL 25.0** and set Input Level to +25.0dBm.
61. Execute **SWP** and perform the measurement.
62. Execute **SLOT_PWR? ALL** and read the measurement result.



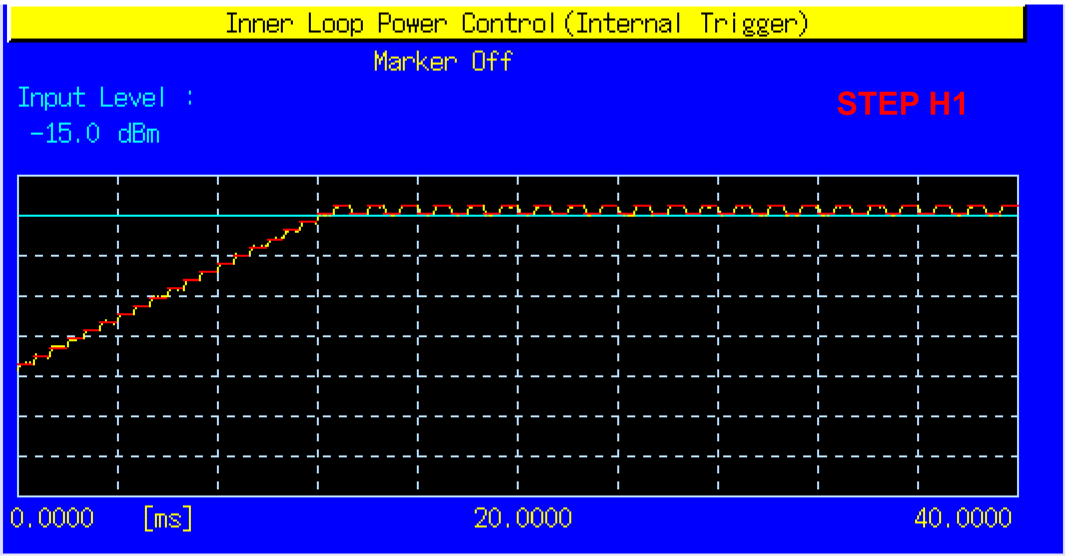
[Step G 1]
63. Execute **ILP_TPC G** and set TPC Test Step to G.
64. Execute **ILP_CMDSLOT G,20** and set the number of slots in Test Step G to 20.
65. Execute **TPCALGO 1** and set TPC Algorithm to 1.
66. Execute **TPCSTEP 2** and set TPC Step Size to 2dB.
67. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
68. Execute **ILVL 25.0** and set Input Level to +25.0dBm.
69. Execute **SWP** and perform the measurement.
70. Execute **SLOT_PWR? ALL** and read the measurement result.



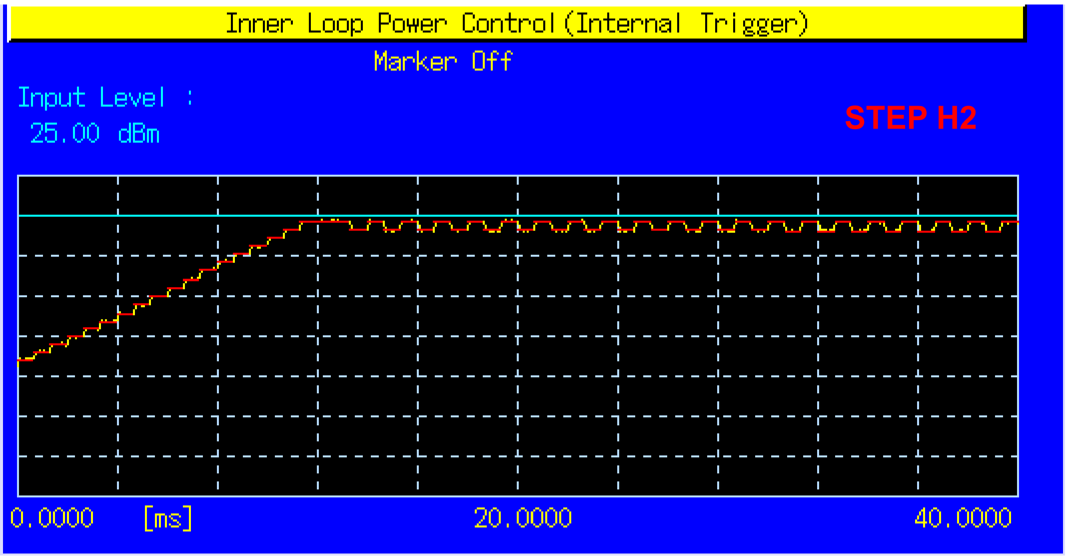
[Step G 2]
71. Execute **ILP_TPC G** and set TPC Test Step to G.
72. Execute **ILP_CMDSLOT G,20** and set the number of slots in Test Step G to 20.
73. Execute **TPCALGO 1** and set TPC Algorithm to 1.
74. Execute **TPCSTEP 2** and set TPC Step Size to 2dB.
75. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
76. Execute **ILVL -15.0** and set Input Level to –15.0dBm.
77. Execute **SWP** and perform the measurement.
78. Execute **SLOT_PWR? ALL** and read the measurement result.



[Step H 1]
79. Execute **ILP_TPC H** and set TPC Test Step to H.
80. Execute **ILP_CMDSLOT H,20** and set the number of slots in Test Step H to 20.
81. Execute **TPCALGO 1** and set TPC Algorithm to 1.
82. Execute **TPCSTEP 2** and set TPC Step Size to 2dB.
83. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
84. Execute **ILVL -15.0** and set Input Level to –15.0dBm.
85. Execute **SWP** and perform the measurement.
86. Execute **SLOT_PWR? ALL** and read the measurement result.



[Step H 2]
87. Execute **ILP_TPC H** and set TPC Test Step to H.
88. Execute **ILP_CMDSLOT H,75** and set the number of slots in Test Step H to 75.
89. Execute **TPCALGO 1** and set TPC Algorithm to 1.
90. Execute **TPCSTEP 2** and set TPC Step Size to 2dB.
91. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
92. Execute **ILVL 25.0** and set Input Level to +25.0dBm.
93. Execute **SWP** and perform the measurement.
94. Execute **SLOT_PWR? ALL** and read the measurement result.

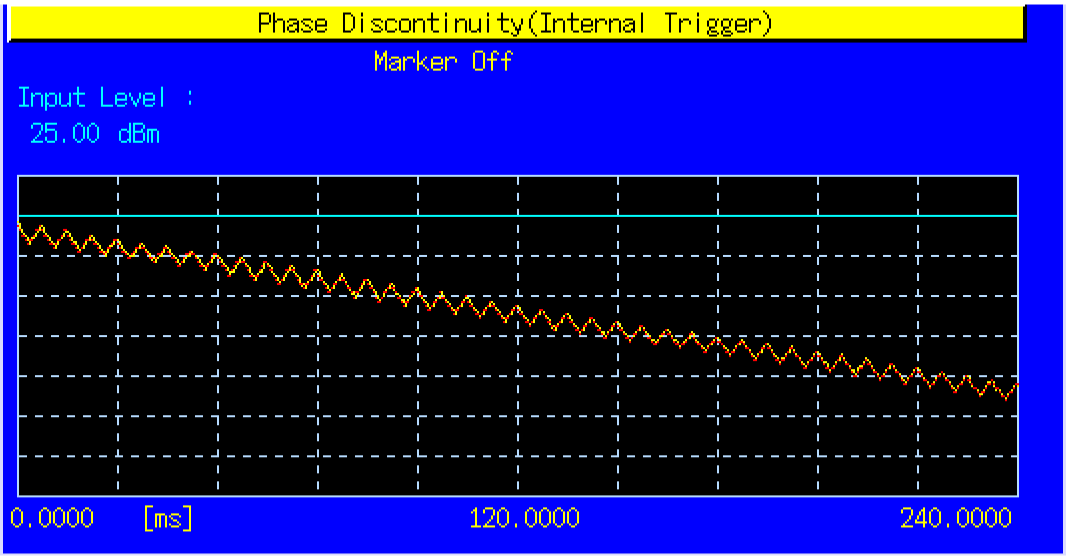


5.13.3 UE phase discontinuity

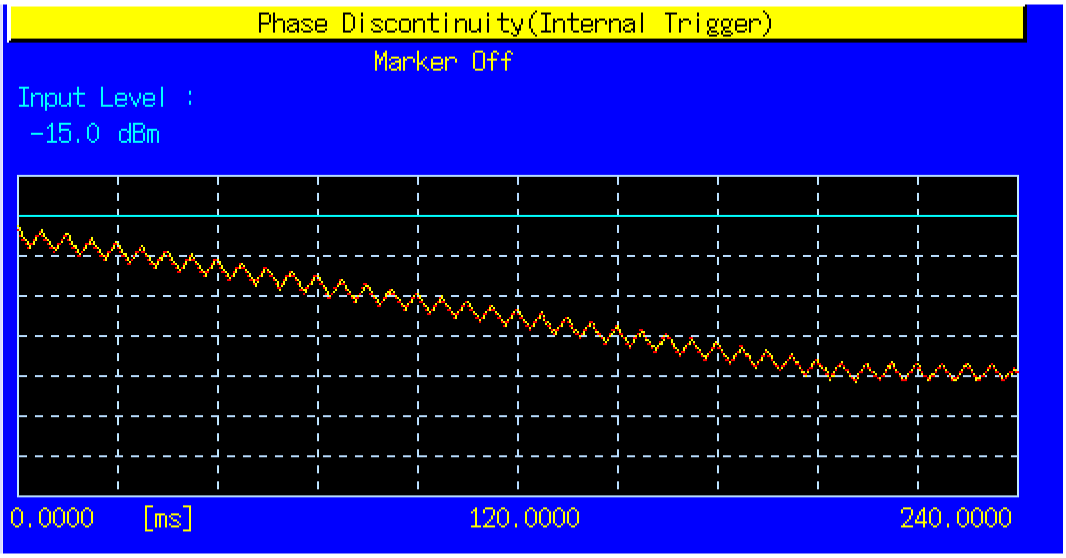
Phase Discontinuity measurement on the Time Domain Measurement screen is used for UE phase discontinuity. Due to the restriction of MT8820A's dynamic range (40dB), it is impossible to perform measurement at a time. Measurement must be performed four times after changing Input Level.

1. Execute **SCRSEL TDMEAS** and display the Time Domain Measurement screen.
2. Execute **MEASOBJ PHASEDISC** and set Measurement Object to Phase Discontinuity.
3. Execute **SLOTLIST ON** and display a slot list.
4. Execute **REGSLOTLIST 0-359** and register Slot0~Slot449 for the slot list.
5. Execute **TIMESPAN 240.0MS** and set Time Span of Time Domain measurement to 400.0ms.
6. Execute **TPCALGO 1** and set TPC Algorithm to 1.
7. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
8. Execute **TDM_RRC OFF** and set RRC Filter to Off.
9. Connect to Test Loop Mode1.
10. Execute **ILVL 25.0** and set Input Level to +25.0dBm.
11. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.

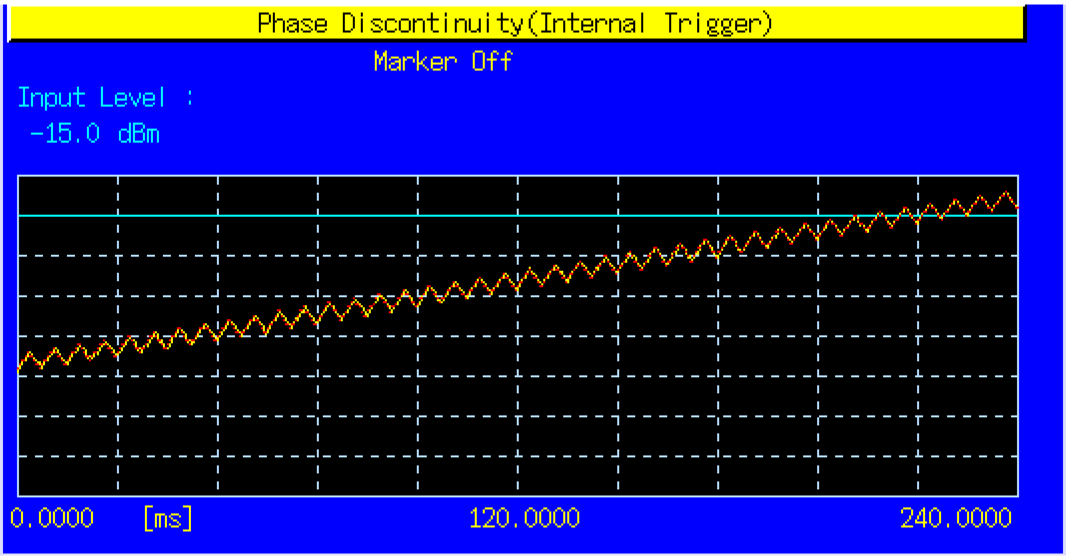
[5Down4Up Step1]
12. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
13. Execute **ILVL 25.0** and set Input Level to +25.0dBm.
14. Execute **ILP_TPC 5DW4UP** and set TPC Test Step to 5Down4Up.
15. Execute **ILP_CMDSLOT 5DW4UP,360** and set the number of slots in 5Down4Up to 360.
16. Execute **SWP** and perform the measurement.
17. Execute **SLOT_PHSAEDISC? ALL** and read the result of Phase Discontinuity measurement.
18. Execute **SLOT_EVM? ALL** and read the result of EVM measurement.
19. Execute **SLOT_FERR? ALL** and read the result of Frequency Error measurement.



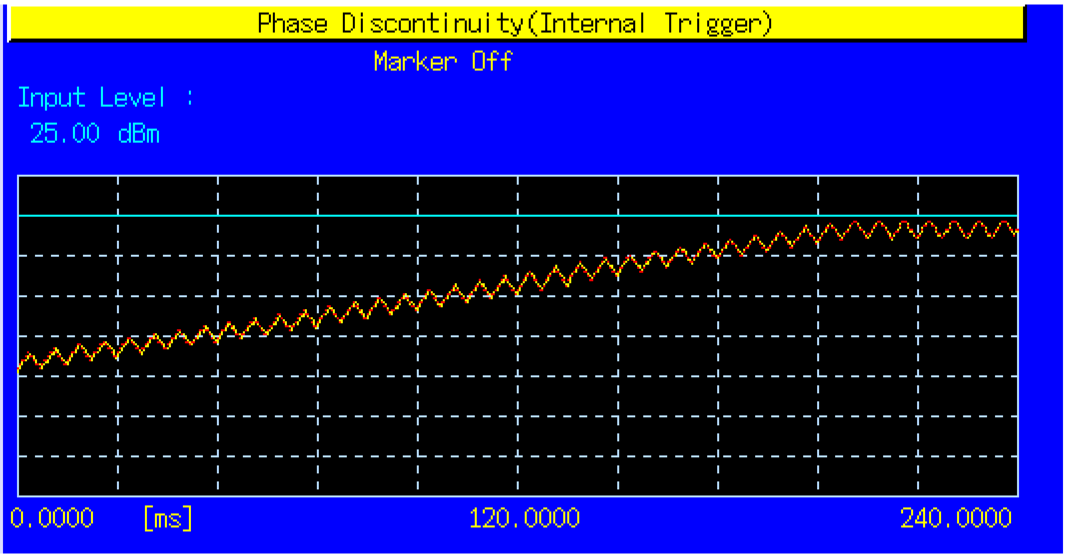
[5Down4Up Step2]
20. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
21. Execute **ILVL -15.0** and set Input Level to –15.0dBm.
22. Execute **ILP_TPC 5DW4UP** and set TPC Test Step to 5Down4Up.
23. Execute **ILP_CMDSLOT 5DW4UP,360** and set the number of slots in 5Down4Up to 360.
24. Execute **SWP** and perform the measurement.
25. Execute **SLOT_PHSAEDISC? ALL** and read the result of Phase Discontinuity measurement.
26. Execute **SLOT_EVM? ALL** and read the result of EVM measurement.
27. Execute **SLOT_FERR? ALL** and read the result of Frequency Error measurement.



[5Up4Down Step1]
28. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
29. Execute **ILVL -15.0** and set Input Level to –15.0dBm.
30. Execute **ILP_CMDSLOT 5UP4DW,360** and set the number of slots in 5Up4Down to 360.
31. Execute **SWP** and perform the measurement.
32. Execute **SLOT_PHSAEDISC? ALL** and read the result of Phase Discontinuity measurement.
33. Execute **SLOT_EVM? ALL** and read the result of EVM measurement.
34. Execute **SLOT_FERR? ALL** and read the result of Frequency Error measurement.



[5Up4Down Step2]
35. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
36. Execute **ILVL 25.0** and set Input Level to +25.0dBm.
37. Execute **ILP_CMDSLOT 5UP4DW,360** and set the number of slots in 5Up4Down to 360.
38. Execute **SWP** and perform the measurement.
39. Execute **SLOT_PHSAEDISC? ALL** and read the result of Phase Discontinuity measurement.
40. Execute **SLOT_EVM? ALL** and read the result of EVM measurement.
41. Execute **SLOT_FERR? ALL** and read the result of Frequency Error measurement.



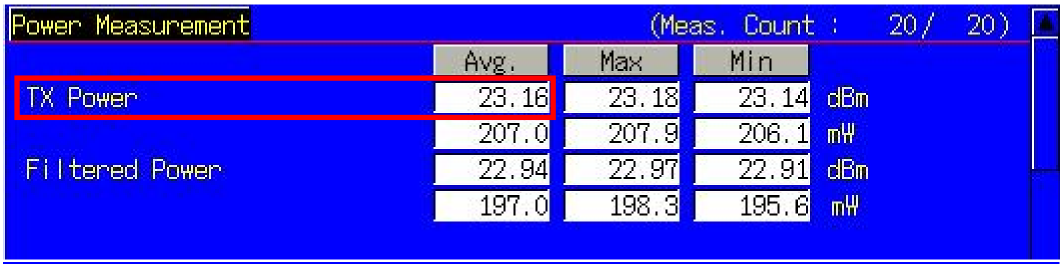
1.6. Other Measurements

5.4.4 Out-of-synchronisation of output power

1. Execute **CALLDROP OFF** and set Call Drop to Off.
2. Execute **UETIM_T313 15** and set T313 to 15s.
3. Execute **UETIM_N313 200** and set N313 to 200
4. Turn on the power of an UE and perform Registration.
5. Connect to Test Loop Mode1.
6. Execute **ILVL 25.0** and set Input Level to 25.0dBm.
7. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
8. Execute **OLVL -61.0** and set Output Level to –61.0dBm.
9. Execute **AWGNLVL 1.0** and set AWGN to On.
10. Execute **AWGNPWR 1.0** and set Ior/Ioc to 1.0dB.
11. Execute **ALLMEASITEMS ON,1,OFF,1,OFF,1OFF,1OFF,1OFF,1OFF,1,OFF,OFF** and set Power Measurement to On and Average Count to 1 times.

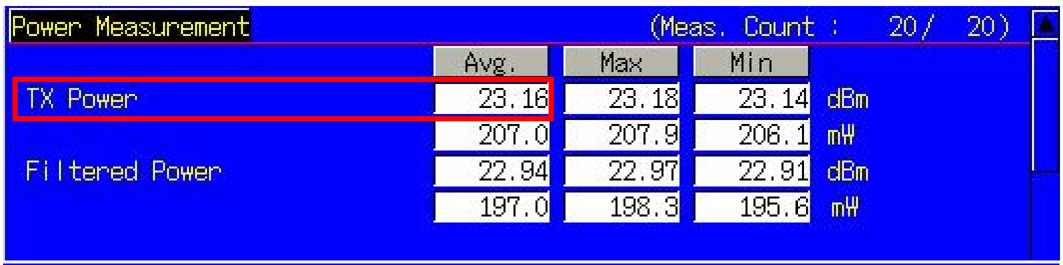
[Step A]

12. Execute **DDPCHPWR -16.6** and set DPCH_Ec/Ior to –16.6dBm.
13. Execute **SWP** and perform power measurement.
14. Execute **AVG_POWER?** and read the result of power measurement.



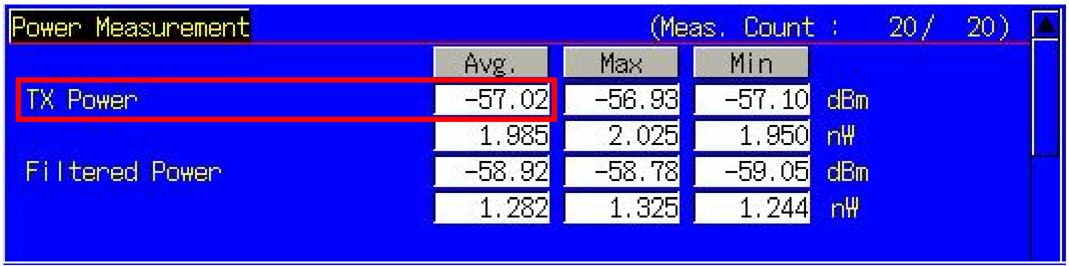
[Step B]

15. Execute **DDPCHPWR -21.6** and set DPCH_Ec/Ior to –21.6dBm.
16. Wait 5seconds
17. Execute **SWP** and perform power measurement.
18. Execute **AVG_POWER?** and read the result of power measurement.



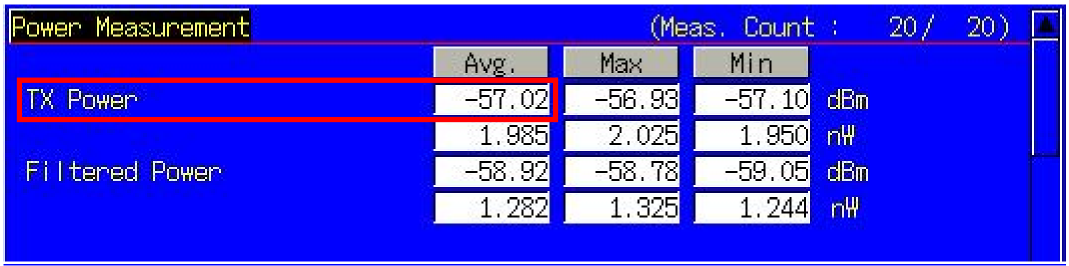
[Step C]

19. Execute **DDPCHPWR -28.4** and set DPCH_Ec/Ior to –28.4dBm.
20. Wait 200ms
21. Execute **SWP** and perform power measurement.
22. Execute **AVG_POWER?** and read the result of power measurement.
23. Wait 5 seconds



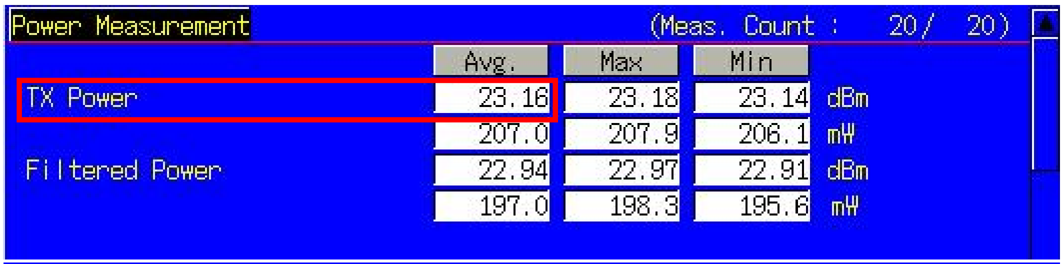
[Step D]

24. Execute **DDPCHPWR -24.4** and set DPCH_Ec/Ior to –24.4dBm.
25. Wait 5 seconds
26. Execute **SWP** and perform power measurement.
27. Execute **AVG_POWER?** and read the result of power measurement.



[Step E]

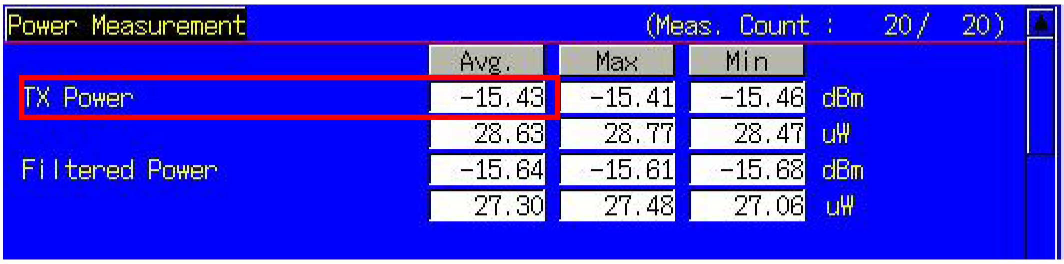
28. Execute **DDPCHPWR -17.6** and set DPCH_Ec/Ior to –17.6dBm.
29. Wait 200 ms
30. Execute **SWP** and perform power measurement.
31. Execute **AVG_POWER?** and read the result of power measurement.



5.6 Change of TFC

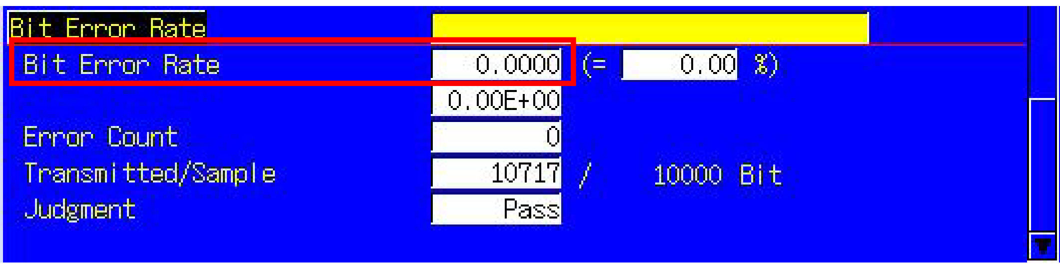
1. Execute **TPCALGO 2** and set TPC Algorithm to 2.
2. Execute **ILVL 0.0** and set Input Level to 0.0dBm.
3. Connect to Test Loop Mode1.
4. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
5. Execute **DTCHPAT PN9** and set DTCH Data Pattern to PN9.
6. Execute **ALLMEASITEMS ON,20,OFF,1,OFF,1OFF,1,OFF,1,OFF,1OFF1,OFF,OFF.**
   Set Power Measurement to On and Average Count to 20 times.
7. Execute **SWP** and perform power measurement.
8. Execute **AVG_POWER?** and read the result of power measurement.

9. Execute **DTCHPAT NODATA** and set DTCH Data Pattern to No Data.
10. Execute **SWP** and perform power measurement.
11. Execute **AVG_POWER?** and read the result of power measurement.



6.3 Maximum Input Level

1. Execute **TPCALGO 2** and set TPC Algorithm to 2.
2. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
3. Connect to Test Loop Mode1.
4. Execute **OLVL -25.7** and set Output Level to –25.7dBm.
5. Execute **DDPCHPWR -19.0** and set DPCH_Ec/Ior to –19.0dB.
6. Execute **ILVL 20.0** and set Input Level to +20.0dBm.
7. Execute **TPCPAT ILPC** and set TPC Pattern to Inner Loop Power Control.
8. Execute **ALLMEASITEMS OFF,1,OFF,1,OFF,1,OFF,1,OFF,1,OFF,1,OFF1,ON,OFF**.
   Set BER Measurement to On.
9. Execute **BER_SAMPLE 10000** and set the number of BER measurement samples to 10000 bits.
10. Execute **SWP** and perform BER measurement.
11. Execute **BER?** and read the result of BER measurement.



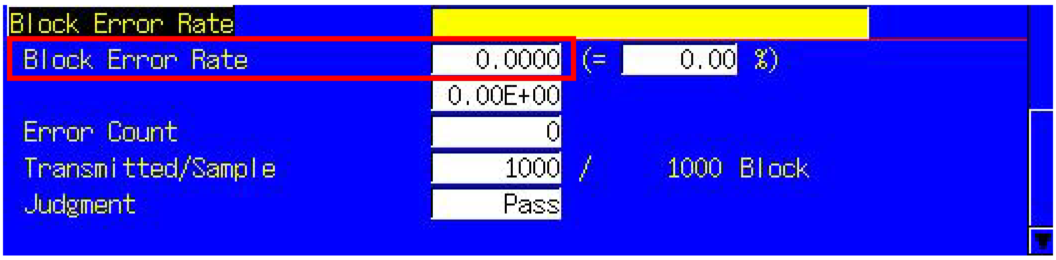
6.8 Spurious Emissions

1. Execute **RRCSTATE CELLFACH** and set RRC State to CELL_FACH.
2. Turn on the power of an UE and perform Registration.
3. Execute **CALLSA** and an UE turns the state of CELL_FACH.
4. Spurious Emissions can be measured by connecting Spectrum Analyzer externally.

7.2 Demodulation in Static Propagation conditions

The following describes the measurement example of the case User bit rate is set to 12.2kbps. Also, measurement can be performed in a similar way for 64kbps, 144kbps and 384kbps by changing measurement parameters.

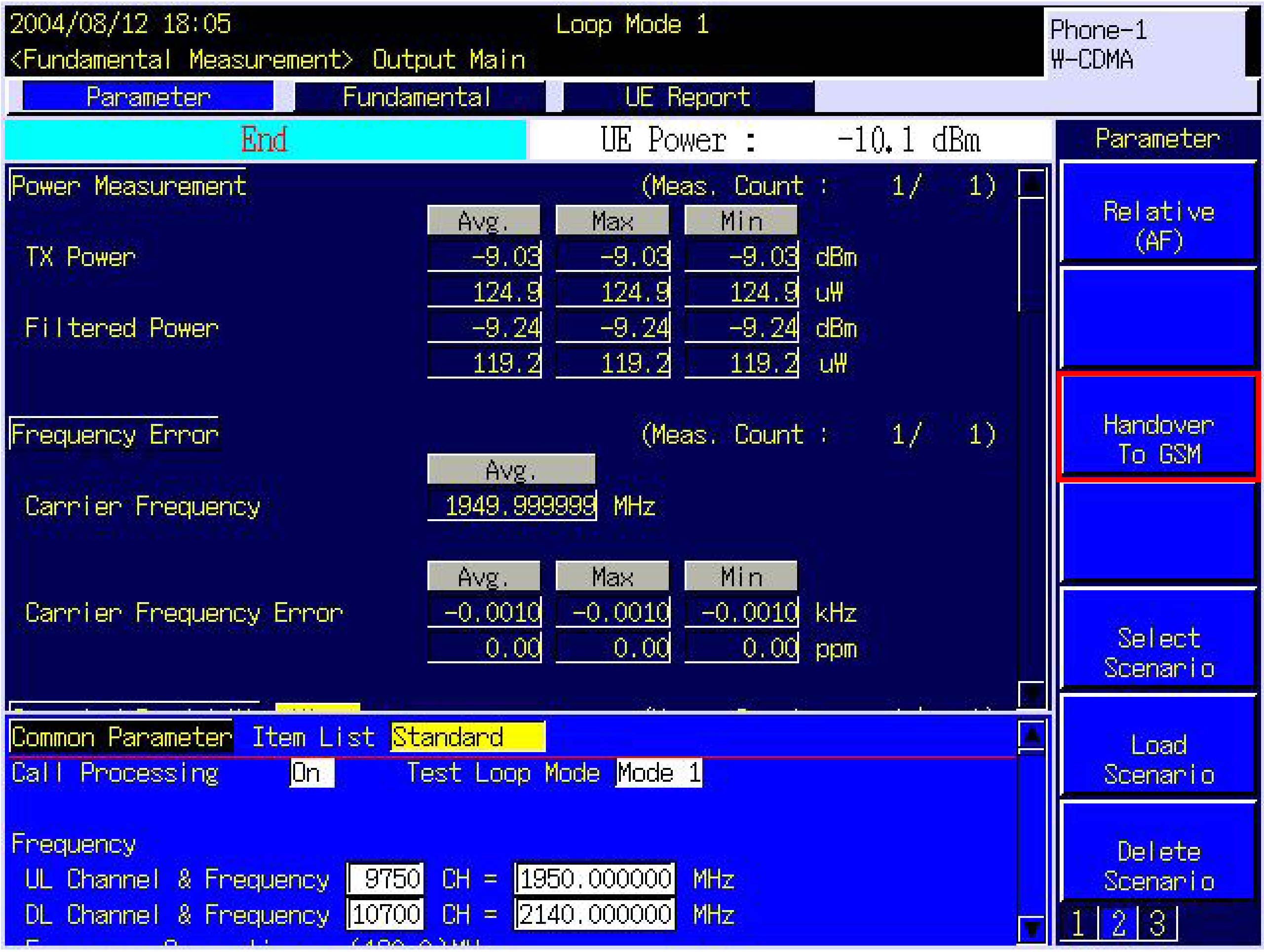
1. Execute **TESTMODE MODE2** and set Test Loop Mode to Mode2.
2. Execute **MAXRATE 12.2** and set Prioritised RABs DL Max Rate to 12.2kbps.
3. Execute **TPCSTEP 1** and set TPC Step Size to 1dB.
4. Connect to Test Loop Mode2.
5. Execute **OLVL -60.7** and set Output Level to –60.7dBm.
6. Execute **AWGNLVL ON** and set AWGN output to On.
7. Execute **AWGNPWR -0.7** and set Ior/Ioc to –0.7dB.
8. Execute **CPICHPWR -10.0** and set CPICH_Ec/Ior to –10.0dB.
9. Execute **PCCPCHPWR -12.0** and set P-CCPCH_Ec/Ior to –12.0dB.
10. Execute **SCHPWR -12.0** and set SCH_Ec/Ior to –12.0dB.
11. Execute **PICHPWR -15.0** and set PICH_Ec/Ior to –15.0dB.
12. Execute **DDPCHPWR -16.5** and set DPCH_Ec/Ior to –16.5dB.
13. Execute **ALLMEASITEMS OFF,1,OFF,1,OFF,1,OFF,1,OFF,1,OFF,1,OFF1,OFF,ON.**
    Set BLER Measurement to On.
14. Execute **BLER_SAMPLE 1000** and set the number of BLER measurement samples to 1000 bits.
15. Execute **SWP** and perform BLER measurement.
16. Execute **BLER?** and read the result of BLER measurement.



1.7. Reduction of W-CDMA/GSM Measurement Time by Inter-RAT Handover

When a single platform performs TRX measurement of W-CDMA and GSM, Inter-RAT Handover of GSM should be performed after all W-CDMA measurements. This eliminates the need for GSM call processing and the measurement time can be reduced as a result. The Output Level must be set a little higher so that the handover won't fail.

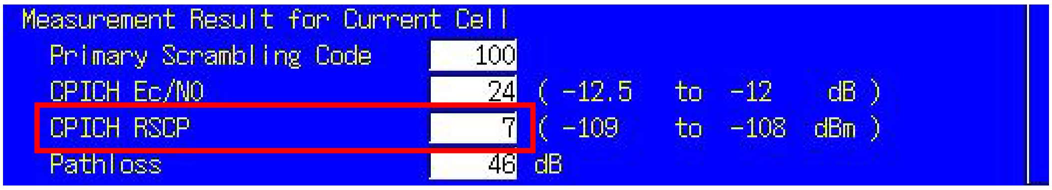
1. Execute **STDSEL GSM** and change the system to GSM.
2. Execute **PRESET,BANDCAL**, etc. and initialize GSM.
3. Execute **STDSEL WCDMA** and change the system to W-CDMA.
4. Execute **PRESET_3GPP,BANDCAL**, etc. and initialize W-CDMA.
5. Connect to Test Loop Mode and perform TRX measurement.
6. Leave it connected to Test Loop Mode after the measurement.
7. Execute **ISHO GSM** and handover to GSM.
8. Perform TRX measurement in GSM.



1.8. UE Report

It is possible to get an UE to submit a Measurement Report. The following describes an example of how to acquire the report value of CPICH RSCP.

1. Perform call processing in Test Loop Mode1.
2. Execute **MEASREP ON** and get an UE to submit a Measurement Report.
3. Execute **CALLRFR** and initialize UE Report value.
4. Execute **CPICH_RSCP? FLAG**. Report is submitted if the response is 1.
5. Execute **CPICH_RSCP?** and read CPICH Ec/N0 value.
6. Return to 3 to read the Report value again.



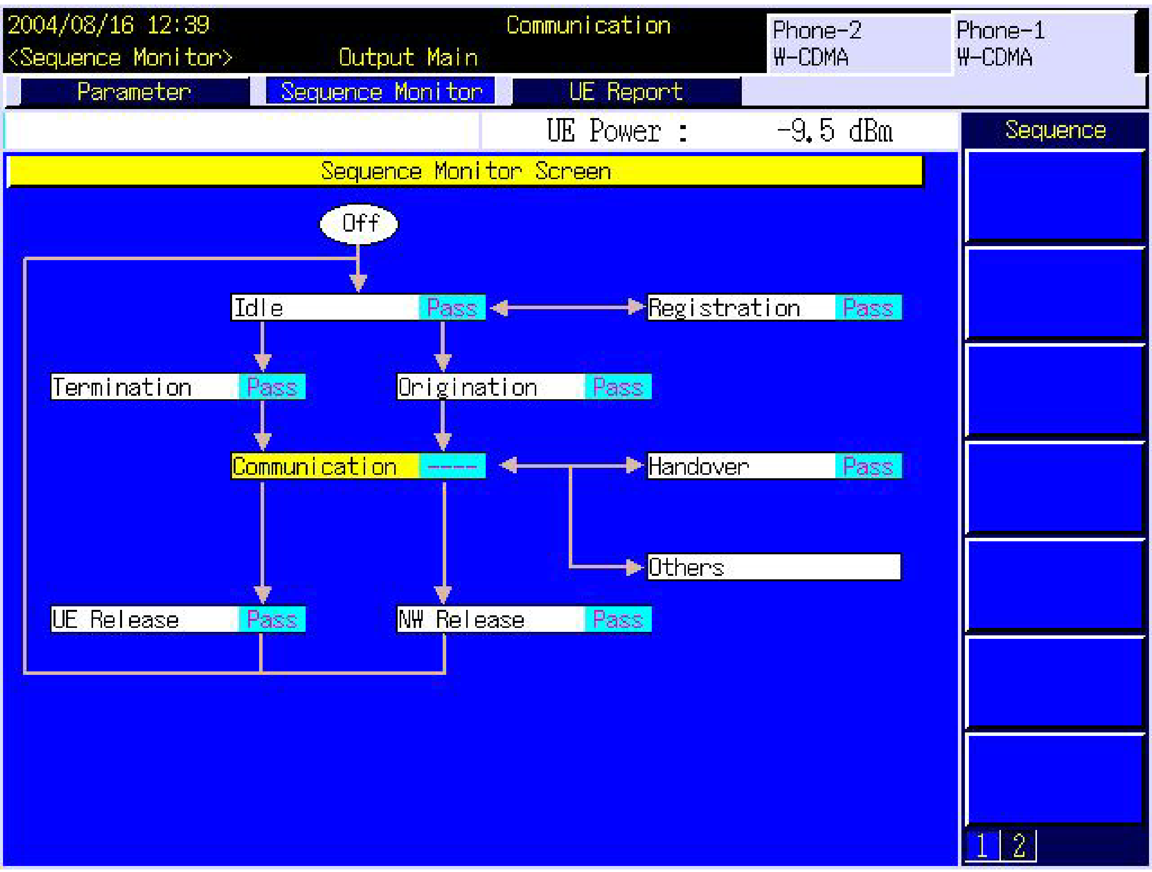
1.9. Functional Test

Voice Call

AMR12.2kbps Voice Call test can be performed in W-CDMA utilizing the call processing function. The following describes an example of Origination test.

1. Set [Call Processing] of Common Parameter to [On].
2. Set [Test Loop Mode] of Common Parameter to [Off].
3. Set [Channel Coding] of Common Parameter to [Voice].
4. Conform [Authentication Key] to the value of SIM if [Integrity] of Call Processing Parameter is set to [On].
5. Make a call from an UE to the arbitrary telephone number.
   Call Processing state turns [Origination]. The originated telephone number can be confirmed on the UE Report screen.
6. Call Processing state turns [Communication]. The MT8820A and the UE can communicate with each other.
7. Set [DTCH Data Pattern] of Common Parameter to [Echo] and perform voice communication test by echo-back.
8. Disconnect from the UE or the MT8820A. Press [End Call] key when disconnecting from the MT8820A.
   Call Processing state turns UE Release or NW Release.

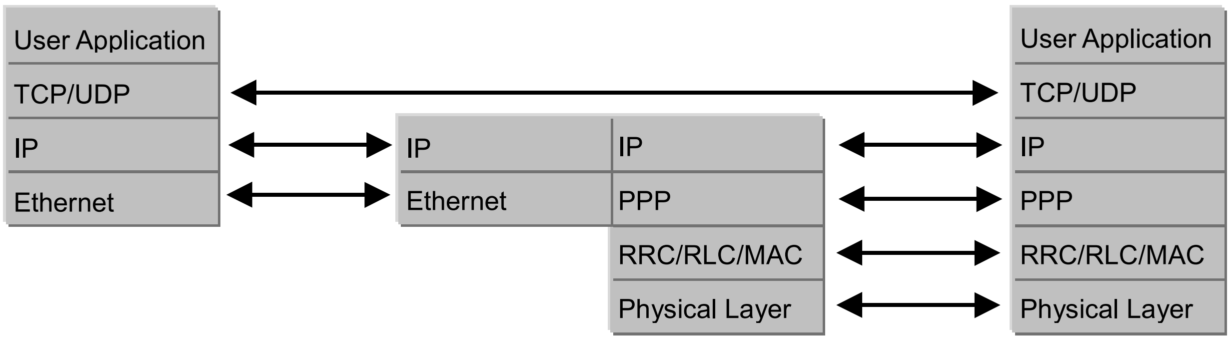
Pass/Fail result of above test can be confirmed on the Sequence Monitor screen.



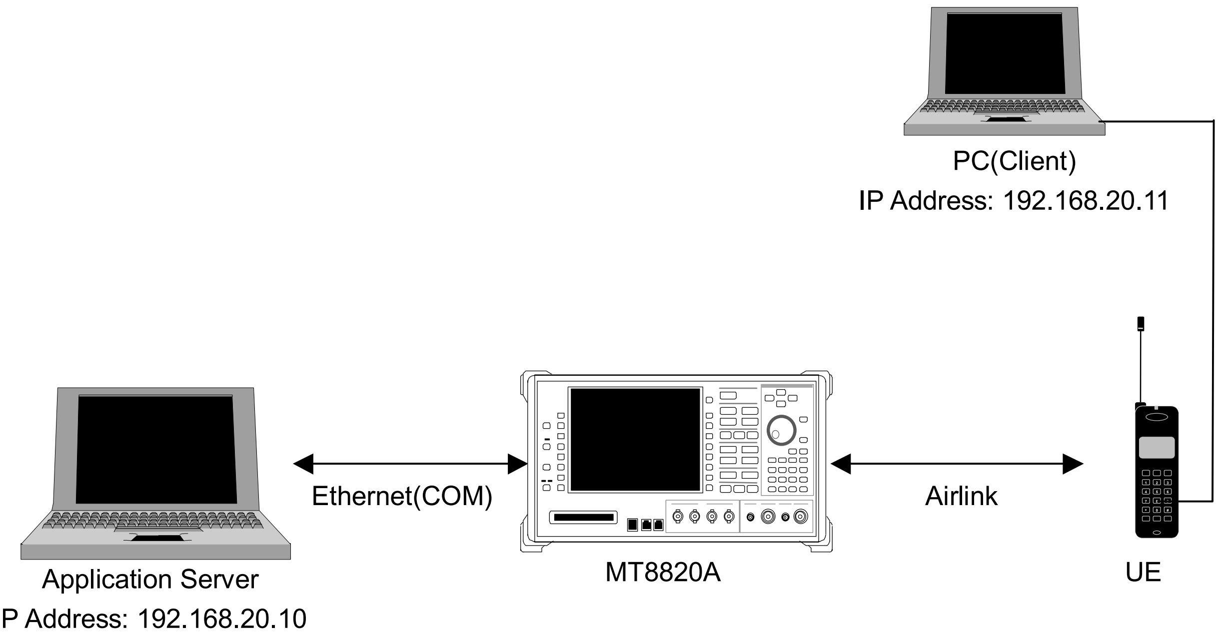
External Packet Data

DL 384kbps and UL64kbps packet connection tests can be performed in W-CDMA utilizing MX88205xA-02W-CDMA External Packet Data option as well as the Call Processing function. PPP and IP connection is supported.

MT8820A enables to perform communications between a server PC and a client PC by supporting PPP or IP protocol communications on the wireless interface with an UE. Generally, PPP is used for dialup connection and IP is used for browsing of contents and sending/receiving of mails with an UE.



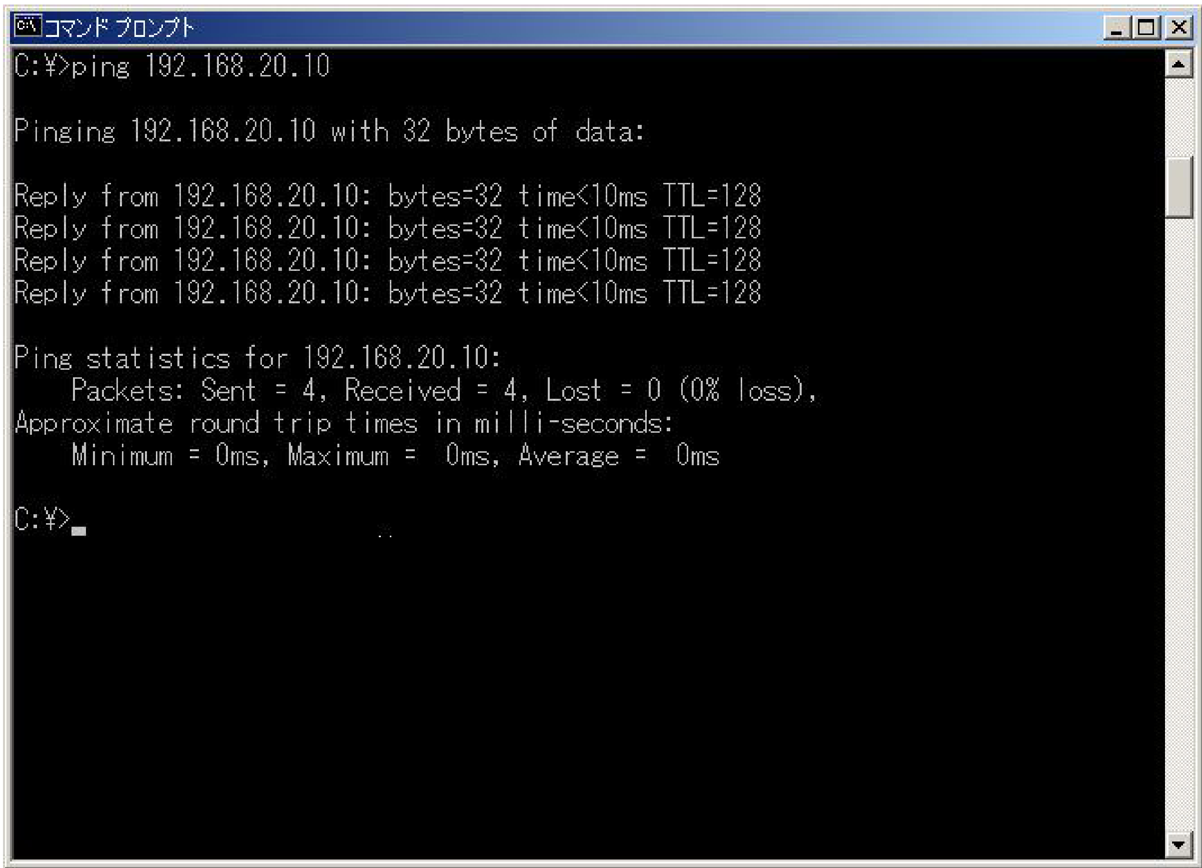
1. Connection without Gateway



<What is prepared>
UE that supports PPP or IP connection
Server PC
Client PC
Cross cable for connecting a MT8820A and a Server PC

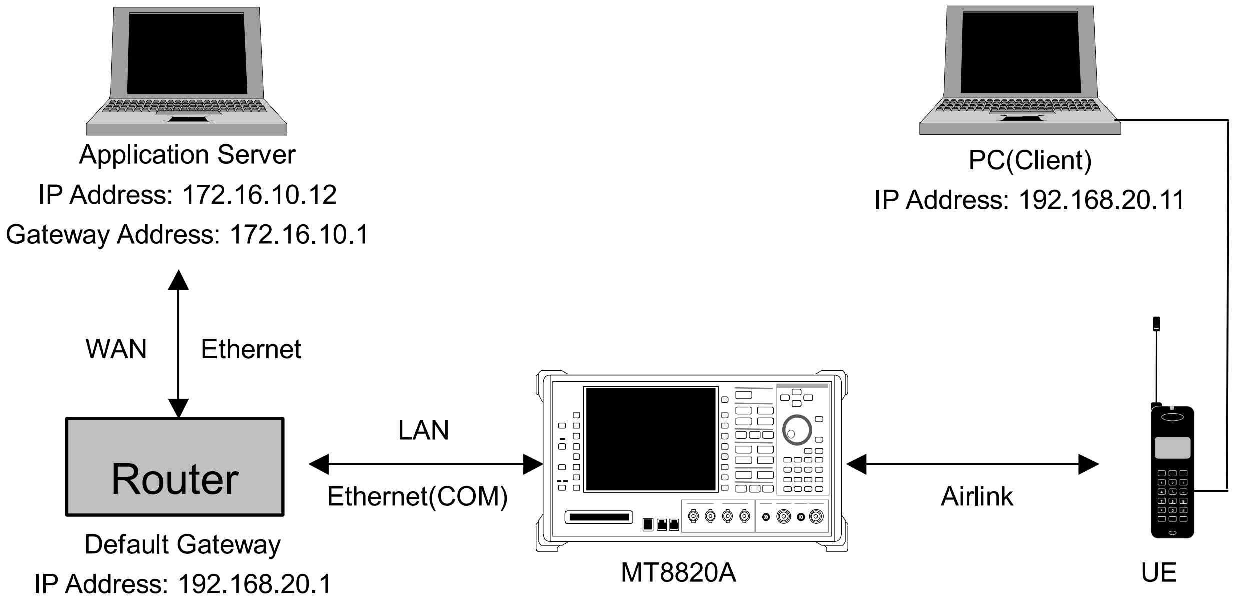
1. Set the Default Gateway address to 0.0.0.0 on the System Config screen. (The Gateway function is disabled.)
2. Reload W-CDMA applications on the Standard Load screen.
3. Set [Call Processing] of Common Parameter to [On].
4. Set [Test Loop Mode] of Common Parameter to [Off].
5. Set [Channel Coding] of Common Parameter to [Packet].
6. Conform [Authentication Key] to the value of SIM if [Integrity] of Call Processing Parameter is set to [On].
7. Set [CPICH_Ec/Ior], [P-CCPCH_Ec/Ior], [SCH_Ec/Ior], [PICH_Ec/Ior] and [DPCH_Ec/Ior] of Physical Channel Parameter to [–6.0dB] respectively.

8. Conform the IP address of a server PC to [Server IP Address] of Call Processing Parameter in MT8820A. Confirm that the PC's DHCP setting is disabled.
9. Confirm that automatic acquisition of the IP address is enabled in the dialup connection property of a client PC.
10. Set [Client IP Address] of Call Processing Parameter, which is allocated to a client PC when connecting.
11. Set [DTCH Data Pattern] of Common Parameter to [External PPP Packet] (PPP connection) or [External IP Packet] (IP connection).
12. Turn on the power of an UE and perform Registration. Registration is performed twice in CS and PS when [Registration Mode] is set to [Auto].
13. Set the user name and password of a client PC for dialup and perform dialup connection.
14. User name: PPP_CLIENT
    Password: MT8820A
15. Call Processing state turns [Communication] and a MT8820A and an UE can communicate with each other.
16. Connection status can be confirmed by sending a ping command from a client PC to a server PC.
17. Also, data transmission speed can be measured by installing the FTP server, etc. in a server PC.
18. Disconnect from a client PC.
19. Call Processing state turns UE Release.



2. Connection with Gateway

The packet communications between different segments can be verified by connecting Gateway between a MT8820A and a Server PC.



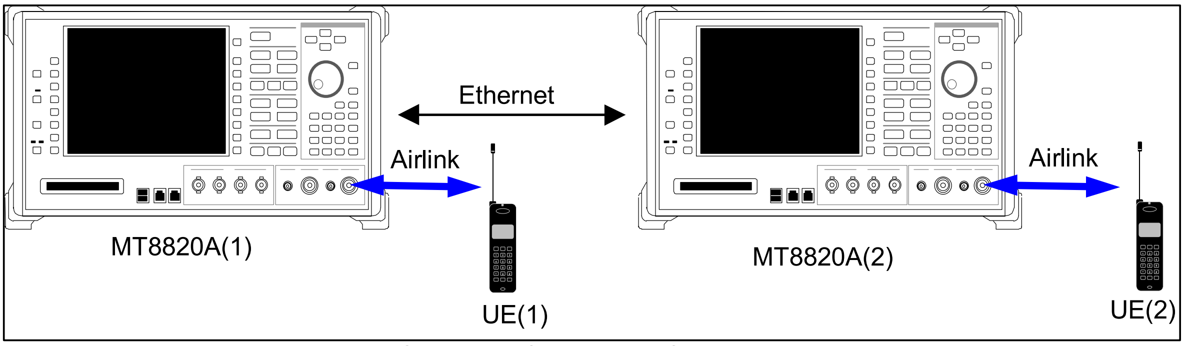
<What is prepared>
UE that supports PPP or IP connection
Server PC
Client PC
Gateway
Straight cable for connecting Gateway and a MT8820A or a Server PC.

1. Set the Default Gateway address and Subnet Mask on the System Config screen. The Default Gateway address must be the same as the IP address on the LAN side of a Router. (For instance, the Default Gateway address of a MT8820A must be set to 192.168.20.1 when the IP address on the LAN side of a Router is set to 192.168.20.1.)
2. Reload WCDMA applications on the Standard Load screen.
3. Set [Call Processing] of Common Parameter to [On].
4. Set [Test Loop Mode] of Common Parameter to [Off].
5. Set [Channel Coding] of Common Parameter to [Packet].
6. Conform [Authentication Key] to the value of SIM if [Integrity] of Call Processing Parameter is set to [On].
7. Set [CPICH_Ec/Ior], [P-CCPCH_Ec/Ior], [SCH_Ec/Ior], [PICH_Ec/Ior] and [DPCH_Ec/Ior] of Physical Channel Parameter to [–6.0dB] respectively.
8. Set the IP address of a server PC. The address must be in the same segment as that on the WAN side of a Router.
9. Set the IP address on the WAN side of a Router to the Default Gateway of a server PC.
10. Confirm that automatic acquisition of the IP address is enabled in the dialup connection property of a client PC.
11. Set [Server IP Address] of Call Processing Parameter. The address must be in the same segment as that of Default Gateway in 1 above.
12. Set [Client IP Address] of Call Processing Parameter, which is allocated to a client PC when connecting. The address must be in the same segment as that of Default Gateway in 1 above.
13. Set [DTCH Data Pattern] of Common Parameter to [External PPP Packet] (PPP connection) or [External IP Packet] (IP connection).
14. Turn on the power of an UE and perform Registration. Registration is performed twice in CS and PS when [Registration Mode] is set to [Auto].
15. Set the user name and password of a client PC for dialup and perform dialup connection.
16. User name: PPP_CLIENT
    Password: MT8820A
17. Call Processing state turns [Communication] and a MT8820A and an UE can communicate with each other.
18. Connection status can be confirmed by sending a ping command from a client PC to a server PC.
19. Also, data transmission speed can be measured by installing the FTP server, etc. in a server PC.
20. Disconnect from a client PC.
21. Call Processing state turns UE Release.

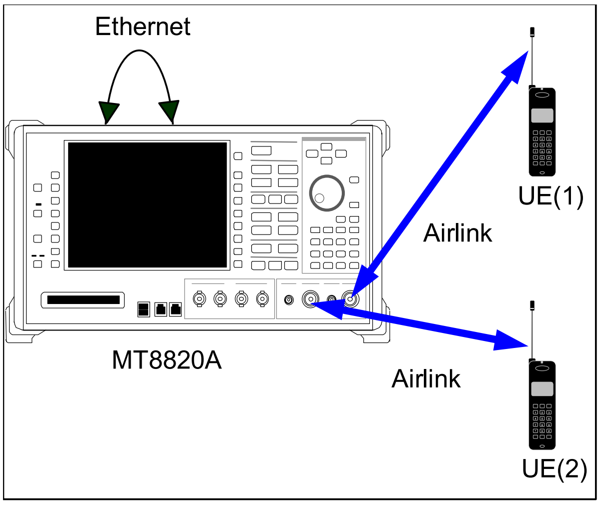
Videophone

The 64kbps end-to-end videophone test can be performed in W-CDMA by respectively connecting two sets of videophones to two sets of MT8820A that have MX88205xA-03 W-CDMA Video Phone Test option with a cross cable.
This test can also be performed by one set of MT8820A that supports parallel phone measurement.

<What is prepared>
Two sets of MT8820A or one set of MT8820A that supports parallel phone measurement
Two sets of videophones
Cross cable for connecting two sets of MT8820A



Connection for two sets of MT8820A



Connection for one set of MT8820A supporting parallel phone measurement

The following describes an example of the end-to-end videophone testing.

1. Connect two 10Base-T port 1 on two sets of MT8820A with each other using a cross cable. In the case of MT8820A that supports parallel phone measurement, connect 10Base-T port 1 and 2 with a cross cable.
2. Set [Call Processing] of Common Parameter to [On].
3. Set [Test Loop Mode] of Common Parameter to [Off].
4. Set [Channel Coding] of Common Parameter to [Audio & Visual].
5. Set [DTCH Data Pattern] of Common Parameter to [No Data].
6. Conform [Authentication Key] to the value of SIM if [Integrity] of Call Processing Parameter is set to [On].
7. Press [Start Call] key of a MT8820A (Phone1 in the case of MT8820A that supports parallel phone measurement) that is connected to UE(1) above.
8. Make a video-phone call from UE(2).
9. Answer the phone immediately when UE(1) starts making a call.
10. Call Processing state turns [Communication] and UE can perform the end-to-end communication with each other.
11. Confirm picture and voice of both videophones.
12. Press [End Call] key of both MT8820A and disconnect the call.
    Call Processing state turns NW Release.

1.10. Calibration Measurement Function

TX Calibration by Slot List

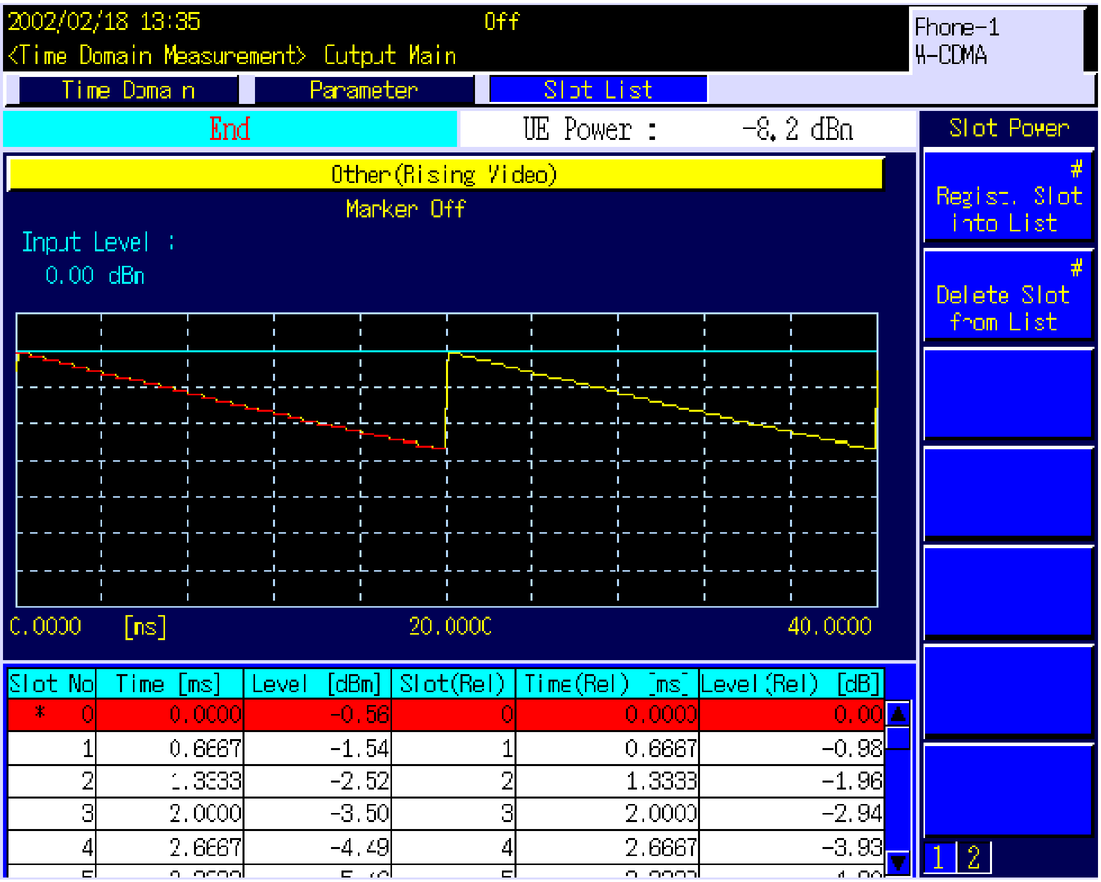
Batch measurement of the power of sequential slots with variable output power allows for simple and high-speed measurement of necessary items and reduction of the time for adjustment process when adjusting UE output power. Slot List of Time Domain measurement enables to measure the average power of sequential slots and acquire them in a batch with a remote command.

Although the measurement range within a slot does not include the transient area that is 25us from slot boundary in default setting, it can be set arbitrarily by measurement start time (**PWRCALSTTM**) and measurement interval (**PWRCALDURAT**). The dynamic range (linearity) of MT8820A is –40dB from Input Level. The range must be divided into some before measurement if the range of measured power exceeds –40dB.

Rising Video, Falling Video and External Trigger can be used for trigger.

(Example) The following describes how to measure the signal of –1dB/slot variation and 2frame cycle.

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



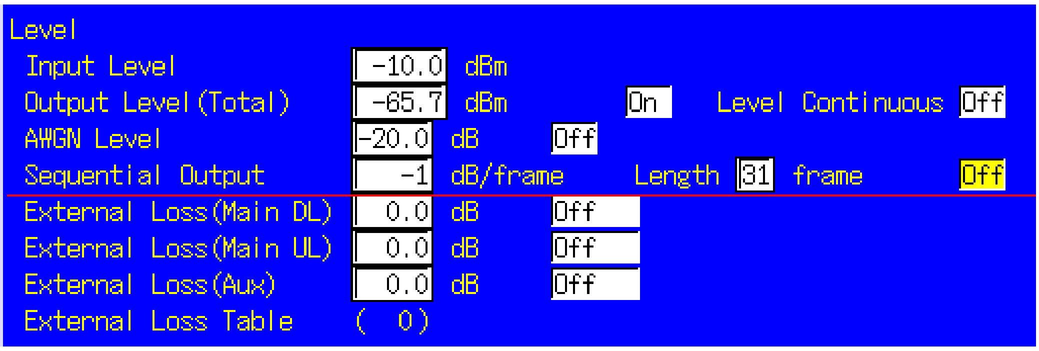
RX Calibration by Sequential Output

MT8820A's Sequential Output function enables to change the level of output signal in cycles. The use of this function reduces the time required for adjustment of UE receiver level.

[Sequential Output specifications and parameters]
Sequential Output function changes the output level per frame in stages and cycles. When adjusting receiver level, several output levels are specified and received by an UE. Measuring instrument's setup procedures are simplified and adjustment time is reduced by automatically changing the signal level per frame.

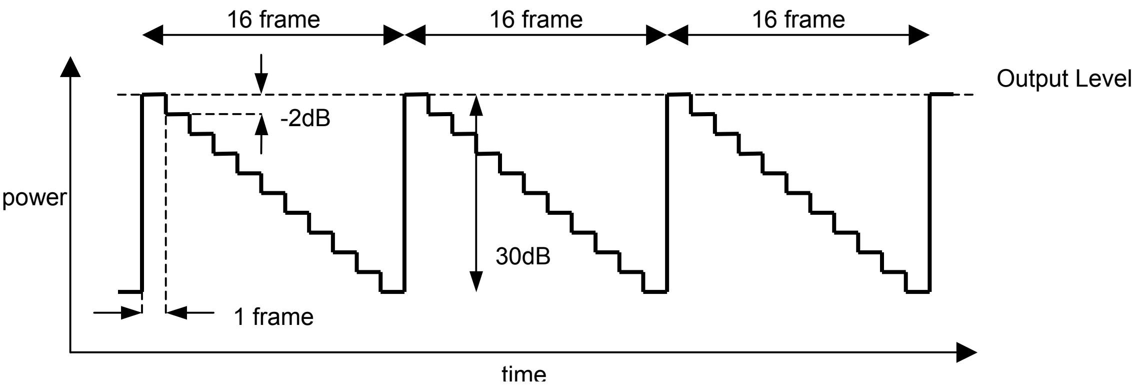
The setting parameter of Sequential Output is displayed when detailed display is specified for common parameter. Fig. 1.10.2-1 shows the setting parameter screen.

Fig. 1.10.2-1 Sequential Output parameter setting screen



When Sequential Output function is set to ON, the power is increased or decreased per frame referenced to Output Level. The parameters to be specified are the variation of output level per frame and frame cycle to be varied. The power is decreased from Output Level if the variation is set with negative value. The power is increased to Output Level(max.) if the variation is set with positive value.
However, the total variation of Sequential Output is 30dB at max. That is, (variation cycle–1)* the maximum absolute value of variation is 30 and the minimum level is –140dBm.

The following is an example of setting.
(Example) –2dB/frame variation, 16frame cycle



[Remote commands]

- Sets the Sequential Output function ON/OFF.

Command

SEQOUTSW sw

Query

SEQOUTSW?

Response

sw

Parameter

sw ON: Sets the Sequential Output function ON.
OFF: Sets the Sequential Output function OFF.

- Sets the variation of the Sequential Output function.

Command

SEQOUTSTEP step

Query

SEQOUTSTEP?

Response

step

Parameter

step Sets the output variation per frame in the Sequential Output function.
Setting range: –30~+30dB. Setting resolution: 1dB.
However, (variation cycle–1)* the maximum of variation is 30dB.

- Sets the variation cycle of the Sequential Output function.

Command

SEQOUTLENG length

Query

SEQOUTLENG?

Response

length

Parameter

length Sets the output variation cycle of the Sequential Output function.
Setting range: 2~31frame. Setting resolution: 1frame.
However, (variation cycle–1)* the maximum of variation is 30dB.

- Sets the parameter of the Sequential Output function.

Command

SEQOUT step,length,sw

Query

SEQOUT?

Response

step,length,sw

Parameter

step Sets the output variation per frame in the Sequential Output function.
Setting range: –30~+30dB. Setting resolution: 1dB.
However, (variation cycle–1)* the maximum of variation is 30dB.

length Sets the output variation cycle of the Sequential Output function.
Setting range: 2~31frame. Setting resolution: 1frame.
However, (variation cycle–1)* the maximum of variation is 30dB.

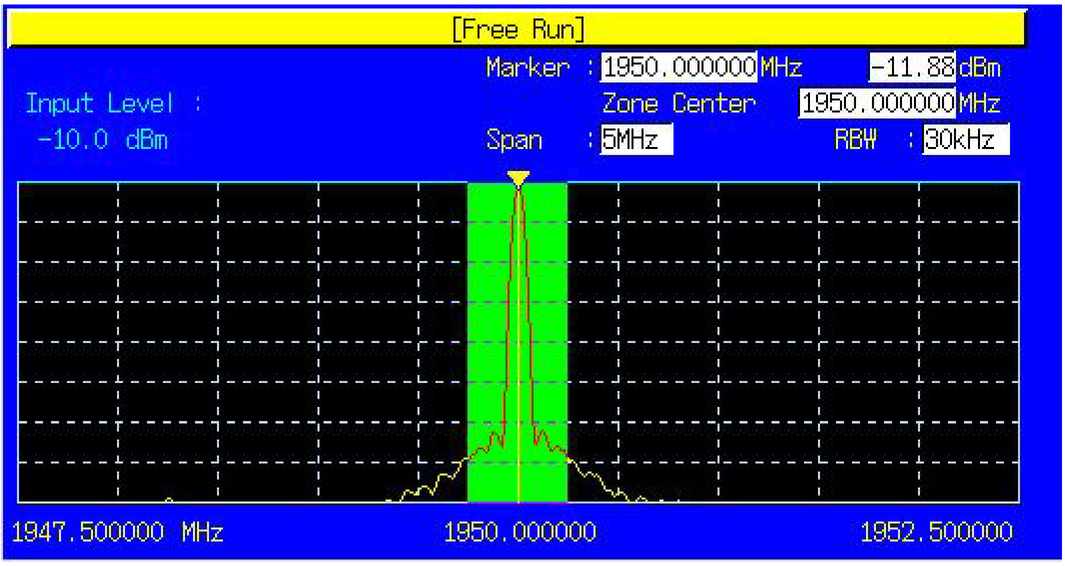
sw ON: Sets the Sequential Output function ON.
OFF: Sets the Sequential Output function OFF.

[Examples of remote control]

```
send( OLVL –60.0dBm );      /* Sets referemce output level to –60.0dBm.*/
send( SEQOUT 2,16,ON );     /* Sets the variation per frame to 2dB, cycle to 16 frames and Sequential Output
                               ON. */
```

Frequency Measurement by Spectrum Monitor

In some cases, frequencies are measured by outputting CW signal from an UE when adjusting UE output frequency. The MT8820A's spectrum monitor has the function to measure frequencies of CW signal.



1) Frequency measurement by the remote command **PEAKFRQ?**

The frequency of CW signal can be measured with higher accuracy than display resolution of spectrum monitor. Measurement accuracy is +/–100Hz at the Frequency Span 25MHz, and +/–10Hz at the Frequency Span 5MHz.

1. Execute **SCRSEL SPMON** and display the Spectrum Monitor screen.
2. Execute **ULFREQ 1950.0MHZ** and set UL Frequency to 1950.0MHz.
3. Execute **ILVL 0.0DBM** and conform Input Level to the UE output level.
4. Execute **SPMSPAN 5** and set Frequency Span to 5MHz.
5. Execute **SPMRBW 30KHZ** and set RBW to 30kHz.
6. Output the signal from an UE.
7. Execute **SWP** and perform the measurement.
8. Execute **PEAKFRQ?** and read the result of frequency measurement.

2) Frequency and level measurement by zone marker

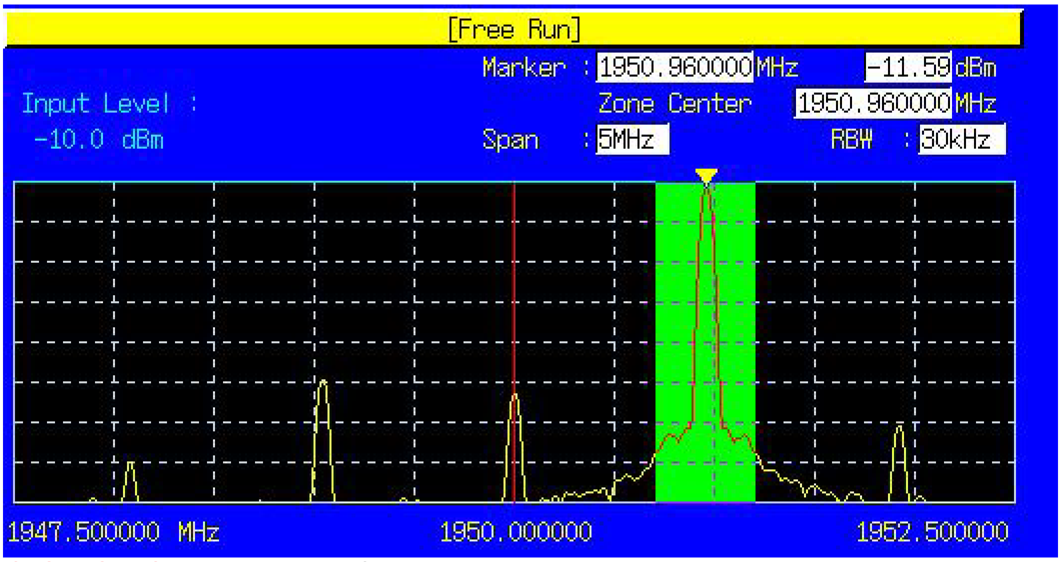
Zone marker enables to measure frequency and level of the maximum level searched within the zone. Zone width is 1/10 of the Frequency Span.

1. Execute **SCRSEL SPMON** and display the Spectrum Monitor screen.
2. Execute **ULFREQ 1950.0MHZ** and set UL Frequency to 1950.0MHz.
3. Execute **ILVL 0.0DBM** and conform Input Level to the UE output level.
4. Execute **SPMSPAN 5** and set Frequency Span to 5MHz.
5. Execute **SPMRBW 30KHZ** and set RBW to 30kHz.
6. Execute **ZMKR_SPM ON** and set Zone Marker to On.
7. Execute **ZMKP_SPM 1950.0MHZ** and set the marker position to 1950.0MHz.
8. Output the signal from an UE.
9. Execute **SWP** and perform the measurement.
10. Execute **ZMKRF_SPM?** and read the result of frequency measurement.
11. Execute **ZMKRL_SPM?** and read the result of level measurement.

Input Level of MT8820A must be specified so that the level of the signal under test exceeds Input Level–30dB.

Adjustment of an Orthogonal Modulator by Spectrum Monitor

In the adjustment of an UE's orthogonal modulator, carrier leak and image level are measured by outputting the rotating pattern from an UE. In order to support the measurement, spectrum monitor has normal marker function for batch reading of levels at arbitrary five frequency points. The normal marker function can specify five frequency points separately from the zone marker on screen. Marker values can be read in a batch and measurement can be performed at high speed in adjustment process. The normal marker function is enabled only by a remote command. The measurement results are not displayed on the spectrum monitor screen.



1. Execute **SCRSEL SPMON** and display the Spectrum Monitor screen.
2. Execute **ULFREQ 1950.0MHZ** and set UL Frequency to 1950.0MHz.
3. Execute **ILVL 0.0DBM** and conform Input Level to the UE output level.
4. Execute **SPMSPAN 5** and set Frequency Span to 5MHz.
5. Execute **SPMRBW 30KHZ** and set RBW to 30kHz.
6. Execute **MKRP_SPM 1948.08MHZ, 1949.04MHZ, 1950.0MHZ, 1950.96MHZ, 1951.92MHZ** and specify the marker points.
7. Output the signal from an UE.
8. Execute **SWP** and perform the measurement.
9. Execute **MKRL_SPM?** and read the marker level.

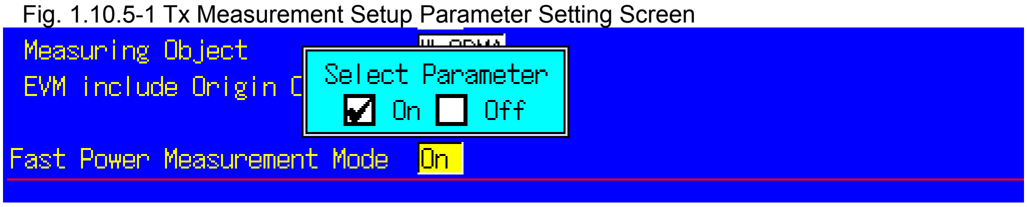
Function		Command	Query	Response	Remarks
Zone Marker					
Marker On / Off	Off	ZMKR_SPM OFF	ZMKR_SPM?	OFF	
	On	ZMKR_SPM ON		ON	
Marker Position		ZMKRP_SPM freq	ZMKRP_SPM?	freq	Freq: equency [1]
Read Out Marker Level		-----	ZMKRL_SPM?	level	Unit = dBm
Read Out Marker Frequency		-----	ZMKRF_SPM?	freq	Freq: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

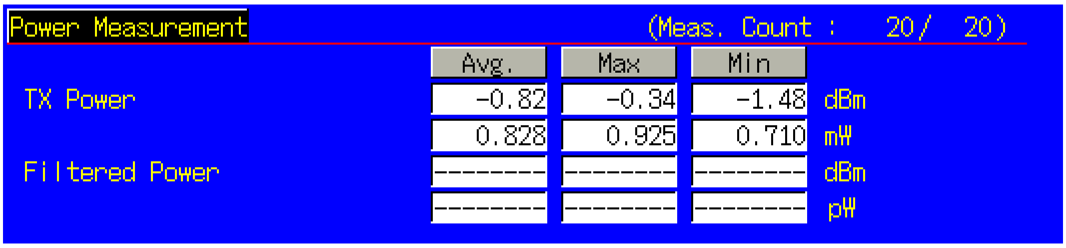
Transmission Power Measurement by Fast Power Measurement Mode

In case the power of a signal under test is stabilized, for example when measuring the transmission power of UE in the adjustment process, power can be measured at a higher speed than usual by setting Fast power Measurement Mode to On. However, the another TX measurement items are not performed when Fast Power Measurement Mode is On. The setting up is to be done in “Fast Power Measurement Mode” in the transmission measurement parameter.

Fig. 1.10.5-1 Tx Measurement Setup Parameter Setting Screen



1. Execute **SCRSEL FMEAS** and display the Fundamental Measurement Screen.
2. Execute **FASTPWRMODE On** and set Fast Measurement Mode to On.
3. Execute **PWR_MEAS On**andset the power measurement to On.
4. Execute **PWR_AVG 20** and set the average count of power measurement to 20
5. Execute **ILVL 0.0DBM** and conform Input Level to the UE output level.
6. Output the signal from UE.
7. Execute **SWP** and perform the measurement.
8. Execute **MKRL_SPM?** and read the marker level.



1.11. HSDPA Measurement

Register of Position in Fixed Reference

When connection is made by HSDPA, the register of position in Fixed Reference Channel is necessary.

1. Execute **PRESET_3GPP** and set to the initial parameter for 3GPP.
2. Execute **CHCODING FIXREFCH** and set Channel Coding to Fixed Reference Channel.
3. Execute **INTEGRITY ON** and set Integrity Protection to On.
4. Set the UE power to On.
5. Execute **CALLSTAT?** and wait for response to be 2(=Idle(Regist)),.

Connection of Fixed Reference Channel

Do the following procedures under the condition resistration of UE position is completed. (Refer to the procedure 1.11.1 describing register of Fixed Reference Channel Position).

[Connection of H-Set1 QPSK]
1. Execute **HSHSET HSET1_QPSK** and set H-Set to H-Set1(QPSK).
2. Execute **CALLSA** and connect in Fixed Reference Channel.
3. Execute **CALLSTAT?** and wait for response to be (=Test Loop Mode).

[Connection of H-Set1 16QAM]
1. Execute **HSHSET HSET1_16QAM**and set H-Set to H-Set1(16QAM).
2. Execute **CALLSA** and connect in Fixed Reference Channel.
3. Execute **CALLSTAT?** and wait for response to be 7. (=Test Loop Mode).

Disconnection of Fixed Reference Channel

1. Execute **CALLSO** and connect Fixed Reference Channel.
2. Execute **CALLSTAT?** and wait for response to be 2(=Idle(Regist)).

Channel Change by Handover

Measurements are normally performed at three frequency points; L, M and H.　When performing these measurements, channel change can be made at a higher speed by changing channel by handover because recoonection is not necessary. Output Level andβc for UL DPCCH must be set at a little higher when performing handover so that it won't fail. Also, GPIB command, which is transmitted during handover, stands by until the handover is terminated.

1. Perform TRX measurement in M channel.
2. Execute **CHAN 9613** and hand over to L channel.
3. Perform TRX measurement.
4. Execute **CHAN 9887** hand over to H channel.
5. Perform the TRX measurement.

Change of Tβc, βd by Transport Channel Reconfiguration

When performing the HSDPA measurement, gain parameters such as βc, βd must be changed based on the measurement condition. Reconnection is not necessary Iif parameter is changed during call processing because the parameter is changed by reconfiguration. . Also, GPIB command, which is transmitted during Transport Channel Reconfiguration, stands by until the handover is terminated

Please set DTCH Data Pttern to No Data for setting βd to OFF as DCCH is not out and call is disconnected if βd is changed to 0.

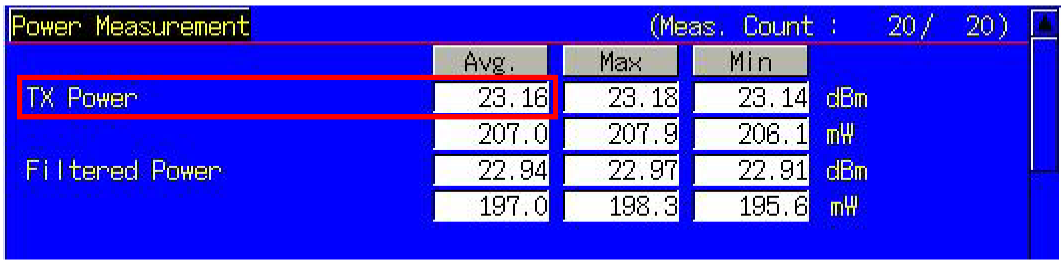
1. Disconnect in Fixed Reference Channel.
2. Execute **ULGAINPAR 1,15,8,8,8** and change βc to 1, βd to 15, Delta ACK to 8, Delta NACK to 8, Delta NACK to 8 and Delta CQI to 8.
3. Perform the TX measurement.
4. Execute **ULGAINPAR 12,15**and change βc to 12, βd to 15.
5. Performe the TX measurement.
6. Execute **ULGAINPAR 13,15**and change βc to 13, βd to 15.
7. Perform the TX measurement.
8. Execute **ULGAINPAR 15,8** and change βc to 15, βd to 8.
9. Perfform the TX measurement.
10. Execute **ULGAINPAR 15,7**and change βc to 15, βd to 7.
11. Perform the TX measurement.
12. Execute **DTCHPAT NODATA**and change DTCH Data Pattern to No Data.
13. Perform the TX measurement.

Selection of the measurement items

Initial setting of MT8820A premises on measurement of W-CDMA. In the initial setting, as the measement items of HSDPA and CQI are set to OFF, set them to On when performing measurement. (**TPUT_MEAS ON, CQI_MEAS ON**). Though another measurement items are set to On. Regarding items which measurement are not necessary such as BER and BLER, performe measurement under the condition Off is set in order to reduce the measurement time. (**BER_MEAS OFF**, **BLER_MEAS OFF**).

5.2A Maximum Output Power with HS-DPCCH

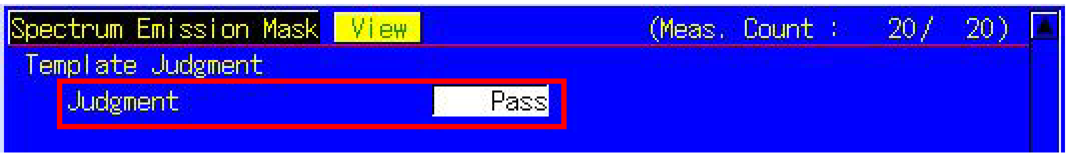
1. Execute **DDPCHTOFS 0** and set DPCH Timing Offset to 0.
2. Execute **ACKREPFACT 3** and set Ack-Nack Repetition Factor to 3.
3. Execute **CQIFEEDBACK 4** and set CQI Feedback Cycleto 4ms.
4. Execute **CQIREPFACT 2** and set CQI Repetition Factor to.2.
5. Connect by Fixed Reference Channel H-Set1(QPSK).
6. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
7. Execute **TPCPAT ALL1** and set TPC Patternto ALL1.
8. Execute **DTCHPAT PN9** and set DTCH Data Pattern to PN9.
9. Execute **PWR_MEAS ON** and set the power measurement to On.
10. Execute **PWR_AVG 20** and set average count of the power measurement to 20 times.
11. Execute **ULGAINPAR 1,15,8,8,8** and set Beta C to 1, Beta D to 15, Delta ACK to 8, Delta NACK to 8, Delta CQI to 8.
12. Execute **SWP** and perform the power measurement.
13. Execute **AVG_POWER?** and read the result ofpower measurement.
14. Execute **ULGAINPAR 12,15** and set Beta C to12, Beta D to 15.
15. Execute **SWP** and perform the result of powe measurement.
16. Execute **AVG_POWER?** and read the result of power measurement.
17. Execute **ULGAINPAR 13,15** and set Beta C to 13, Beta D to 15.
18. Execute **SWP** and perform the power measurement.
19. Execute **AVG_POWER?** and read the result of power measurement.
20. Execute **ULGAINPAR 15,8** and set Beta C to 15, Beta D to 8.
21. Execute **SWP** and perform the power measurement.
22. Execute **AVG_POWER?** and read the result of power measurement.
23. Execute **ULGAINPAR 15,7** and set Beta C to 15, Beta D to 7.
24. Execute **SWP** and perform the power measurement.
25. Execute **AVG_POWER?** and read the result of power measurement.
26. Perform **DTCHPAT NODATA** and set DTCH Data Patternto No Data.
27. Perform **SWP** and perform the power measurement.
28. Perform **AVG_POWER?** and read the result of power measurement.



TX Power corresponds to Mean power (5MHz bandwidth), Filtered Power corresponds to RRC filtered mean power.

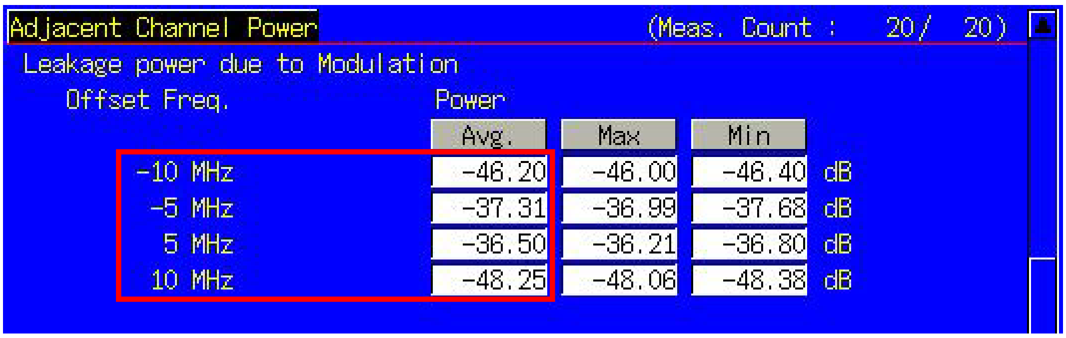
5.9A Spectrum Emission Mask with HS-DPCCH

1. Execute **DDPCHTOFS 0** and set DPCH Timing Offset to 0.
2. Execute **ACKREPFACT 3** and set Ack-Nack Repetition Factor to 3.
3. Execute **CQIFEEDBACK 4** and set CQI Feedback Cycle to 4ms.
4. Execute **CQIREPFACT 2** and set CQI Repetition Factor to 2.
5. Execute Connect by Fixed Reference Channel H-Set1(QPSK).
6. Execute **ILVL 35.0** and set Input Level to 35.0dBm.
7. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
8. Execute **DTCHPAT PN9** and set DTCH Data Pattern to PN9.
9. Execute **SMASK_MEAS ON** and set the SEM measurement to On.
10. Execute **SMASK_AVG 20** and set the average count of SEM measurement to 20 times.
11. Execute **ULGAINPAR 1,15,8,8,8** and set Beta C to 1, Beta D to 15, Delta ACK to 8, Delta NACK to 8, Delta CQI to 8.
12. Execute **SWP** and perform the SEM measurement.
13. Execute **SMASKPASS?** and read the judgement result of SEM measurement.
14. Execute **ULGAINPAR 12,15** and set Beta C to 12, Beta D to 15.
15. Execute **SWP** and perform the SEM measurement.
16. Execute **SMASKPASS?** and read the judgement result of SEM measurement.
17. Execute **ULGAINPAR 13,15** and set Beta C to 13, Beta D to 15.
18. Execute **SWP** and perform the SEM measurementant.
19. Execute **SMASKPASS?** and read the judgement of SEM measurement.
20. Execute **ULGAINPAR 15,8** and set Beta C to 15, Beta D to 8.
21. Execute **SWP** and perform the SEM measurement.
22. Execute **SMASKPASS?** and read the judgement result of SEM measurement.
23. Execute **ULGAINPAR 15,7** and set Beta C to15, Beta D to 7.
24. Execute **SWP** and perform the SEM measurement.
25. Execute **SMASKPASS?** and read the judgement result of SEM measurement.
26. Execute **DTCHPAT NODATA** and set DTCH Data Pattern to No Data.
27. Execute **SWP** and perform the SEM measurement.
28. Execute **SMASKPASS?** and read the judgement result of the SEM measurement.



5.10A Adjacent Channel Leakage Power Ratio (ACLR) with HS-DPCCH

1. Execute **DDPCHTOFS 0** and set DPCH Timing Offset to 0.
2. Execute **ACKREPFACT 3** and set Ack-Nack Repetition Factor to 3.
3. Execute **CQIFEEDBACK 4** and set CQI Feedback Cycle to 4ms.
4. Execute **CQIREPFACT 2** and set CQI Repetition Factor to 2.
5. Connect by Fixed Reference Channel H-Set1(QPSK).
6. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
7. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
8. Execute **DTCHPAT PN9** and set DTCH Data Pattern to PN9.
9. Execute **ADJ_MEAS ON** and set the ACLR measurement to On.
10. Execute **ADJ_AVG 20**and set the average count of ACLR measurement to 20 times.
11. Execute **ULGAINPAR 1,15,8,8,8** and set Beta C to 1, Beta D to 15, Delta ACK to 8, Delta NACK to 8, Delta CQI to 8.
12. Execute **SWP**and perform the ACLR measurement.
13. Execute **AVG_MODPWR? LOW10, AVG_MODPWR? LOW5, AVG_MODPWR? UP5, AVG_MODPWR? UP10** and read the judgement result of ACLR.
14. Execute **ULGAINPAR 12,15** and set Beta C to 12, Beta D to 15.
15. Execute **SWP** and perform the ACLR measurement.
16. Execute **AVG_MODPWR? LOW10, AVG_MODPWR? LOW5, AVG_MODPWR? UP5, AVG_MODPWR? UP10** and read the result of ACLR measurement.
17. Execute **ULGAINPAR 13,15**and set Beta C to 13, Beta D to15.
18. Execute **SWP** and performe the ACLR measurement.
19. Execute **AVG_MODPWR? LOW10, AVG_MODPWR? LOW5, AVG_MODPWR? UP5, AVG_MODPWR? UP10** and read the judgement result of ACLR result.
20. Execute **ULGAINPAR 15,8** and set Beta C to 15, Beta D to 8.
21. Execute **SWP**and perform the ACLRmeasurement.
22. Execute **AVG_MODPWR? LOW10, AVG_MODPWR? LOW5, AVG_MODPWR? UP5, AVG_MODPWR? UP10** and read the ACLR measurement.
23. Execute **ULGAINPAR 15,7** and set Beta C to 15, Beta D to 7.
24. Execute **SWP** and perform the ACLR measurement.
25. Execute **AVG_MODPWR? LOW10, AVG_MODPWR? LOW5, AVG_MODPWR? UP5, AVG_MODPWR? UP10** and read the result of ACLR measurement.
26. Execute **DTCHPAT NODATA** and set DTCH Data Pattern to No Data.
27. Execute **SWP**and perform the ACLR measurement.
28. Execute **AVG_MODPWR? LOW10, AVG_MODPWR? LOW5, AVG_MODPWR? UP5, AVG_MODPWR? UP10** and perform the result of ACLR measurement.



5.13.1A Error Vector Magnitude (EVM) with HS-DPCCH

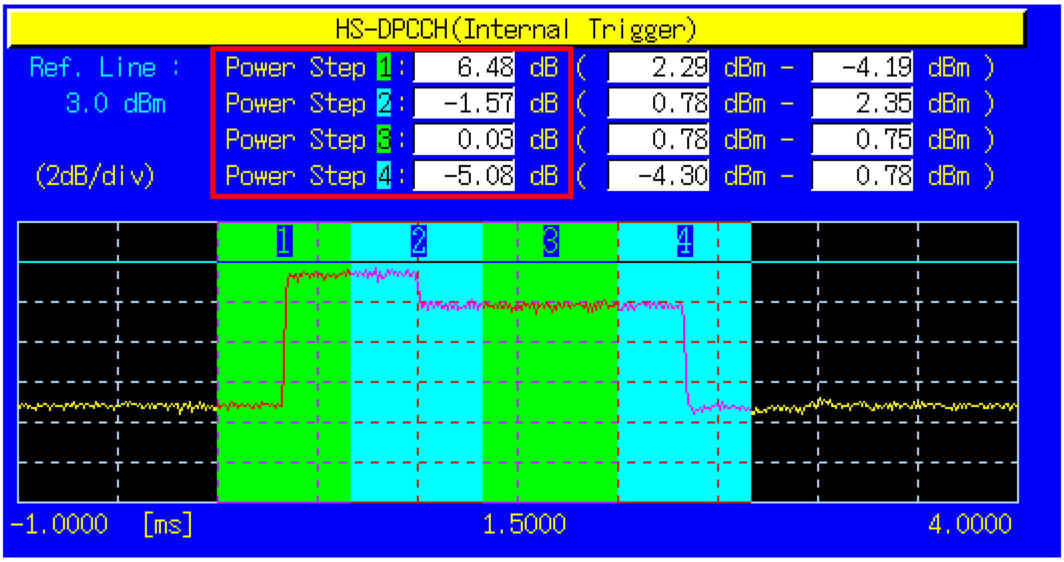
1. Execute **DDPCHTOFS 0** and set DPCH Timing Offset to 0.
2. Execute **ACKREPFACT 3** and set Ack-Nack Repetition Factor to 3.
3. Execute **CQIFEEDBACK 4** and set QI Feedback Cycle to 4ms.
4. Execute **CQIREPFACT 2** and set CQI Repetition Factor to 2.
5. Execute **TPCALGO 2** and set TPC Algorithm to 2.
6. Connect by Fixed Reference Channel H-Set1(QPSK).
7. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
8. Execute **TPCPAT ALL1** and set Pattern to ALL1.
9. Execute **DTCHPAT PN9** and set DTCH Data Pattern to PN9.
10. Execute **MOD_MEAS ON** and set the Modulation Analysis measurement to On.
11. Execute **MOD_AVG 20** and set the average count of Modulation Analysis measurement to 20 times.
12. Execute **ULGAINPAR 1,15,8,8,8** and set Beta C to 1, Beta D to15, Delta ACK to 8, Delta NACK to 8, Delta CQI to 8.
13. Execute **SWP** and execute the Modulation Analysis measurement.
14. Execute **AVG_EVM?** and read the result of EVM measurement.
15. Execute **ULGAINPAR 12,15** and set Beta C to 12, Beta D to 15.
16. Execute **SWP** and perform the Modulation Analysis measurement.
17. Execute **AVG_EVM?** and read the result of EVM measurement.
18. Execute **ULGAINPAR 13,15** and set Beta C to 13, Beta D to 15.
19. Execute **SWP** and perform the Modulation Analysis measurement.
20. Execute **AVG_EVM?** and read the result of the EVM measurement.
21. Execute **ULGAINPAR 15,8** and set Beta C to 15, Beta D to 8.
22. Execute **SWP** and perform the Modulation Analysis measurement.
23. Execute **AVG_EVM?** and read the result of EVM measurement.
24. Execute **ULGAINPAR 15,7** and set Beta C to 15, Beta D to 7.
25. Execute **SWP** and perform the Modulation Analysis measurement.
26. Execute **AVG_EVM?** and read the result of EVM measurement.
27. Execute **DTCHPAT NODATA** and set DTCH Data Pattern to No Data.
28. Execute **SWP** perform the Modulation Analysis measurement.
29. Execute **AVG_EVM?** and read the result of EVM measurement.
30. Execute **TPCPAT ILPC** and set TPC Pattern to Inner Loop Power Control.
31. Execute **ILVL -20.0** and set Input Level to –20.0dBm.
32. Wait for abou 200mm seconds until the UE power get –20.0dBm.
33. Execute **TPCPAT ALT** and set TPC Pattern to Alternate.
34. Repeat the procedure 12~29.

5.7A HS-DPCCH

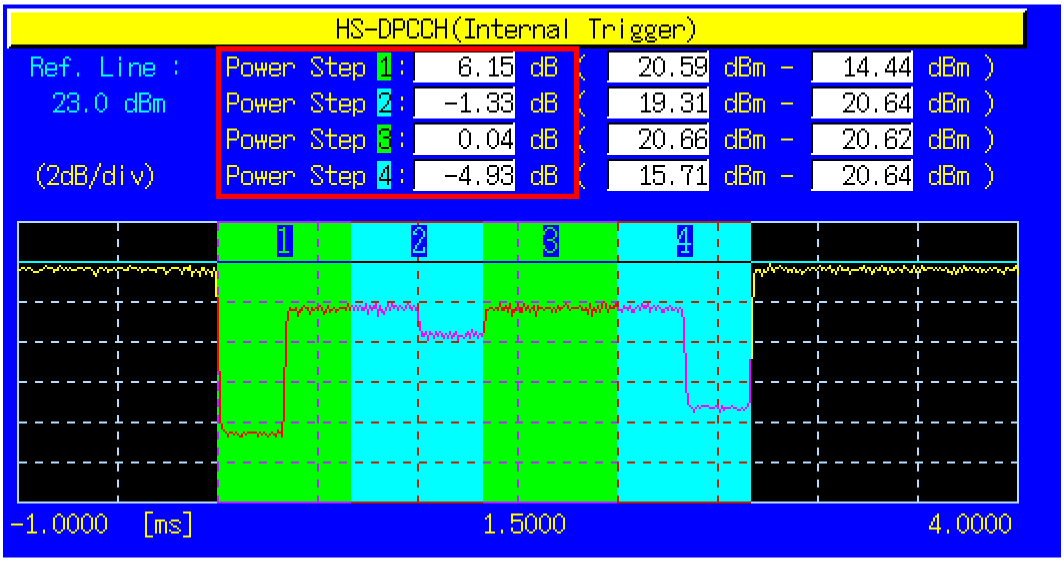
1. Execute **DDPCHTOFS 6** and set DPCH Timing Offset to 6.
2. Execute **ACKREPFACT 1** and set Ack-Nack Repetition Factor to 1.
3. Execute **CQIFEEDBACK 4** and set CQI Feedback Cycle to 4ms.
4. Execute **CQIREPFACT 1** and set CQI Repetition Factor to 1.
5. Execute **TPCALGO 2** and set TPC Algorithm to 2.
6. Connect by Fixed Reference Channel H-Set1(QPSK).
7. Execute **SCRSEL TDMEAS** and set Screen to Time Domain Measurement.
8. Execute **MEASOBJ HSDPCCH** and set Measurement Object to HS-DPCCH.

[βc=15, βd=7]

9. Execute **ULGAINPAR 15,7,8,8,7** and set Beta C to 15, Beta D to 7, Delta ACK to 8, Delta NACK to 8, Delta CQI to 7.
10. Execute **DTCHPAT PN9** and set DTCH Data Pattern to PN9.
11. Execute **TPCPAT ILPC** and set TPC Pattern to Inner Loop Power Control.
12. Execute **ILVL 0.0** and set Input Level to 0.0dBm.
13. Wait about 100mm seconds until the UE power gets to 0.0dBm.
14. Execute **SWP** and perform the HS-DPCCH measurement.
15. Execute **TTL_STEP_HSPWR?** and read the result HS-DPCCH measurement.

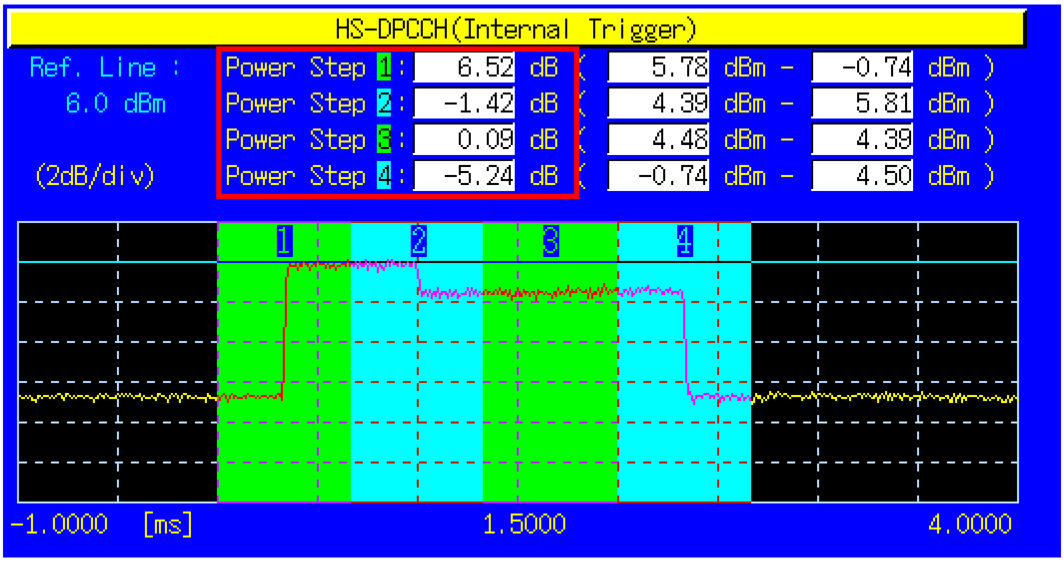


16. Execute **ILVL 35.0**and set Input Level to +35.0dBm.
17. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
18. Wait about 100mm seconds until the UE get the maximum power.
19. Execute **SWP**and perform the HS-DPCCH measurement.
20. Execute **TTL_STEP_HSPWR?** and read the result of HS-DPCCH measurement.

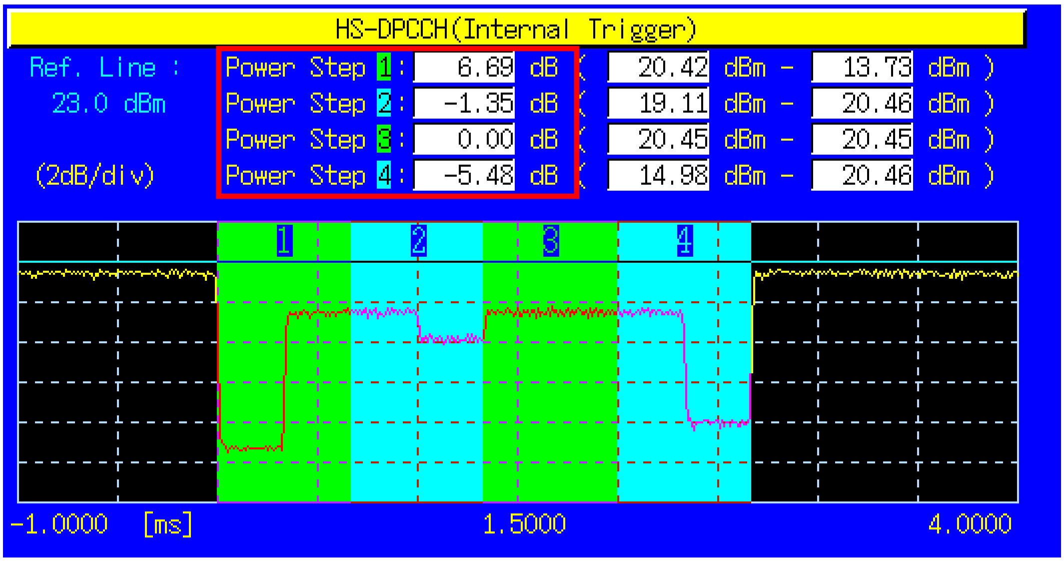


[βc=15, βd=0]

21. Execute **ULGAINPAR 15,7,8,8,7** and set Beta C to 15, Beta D to 7, Delta ACK to 8, Delta NACK to 8, Delta CQI to 7.
22. Execute **DTCHPAT NODATA** and set DTCH Data Pattern to No Data.
23. Execute **ILVL 0.0** and set Input Level to 0.0dBm.
24. Execute **TPCPAT ILPC** and set TPC Pattern to Inner Loop Power Control.
25. Wait about 100mm seconds until the UE power is 0.0dBm.
26. Perform **SWP** perform the HS-DPCCH measurement.
27. Perform **TTL_STEP_HSPWR?** and read the HS-DPCCH measurement.

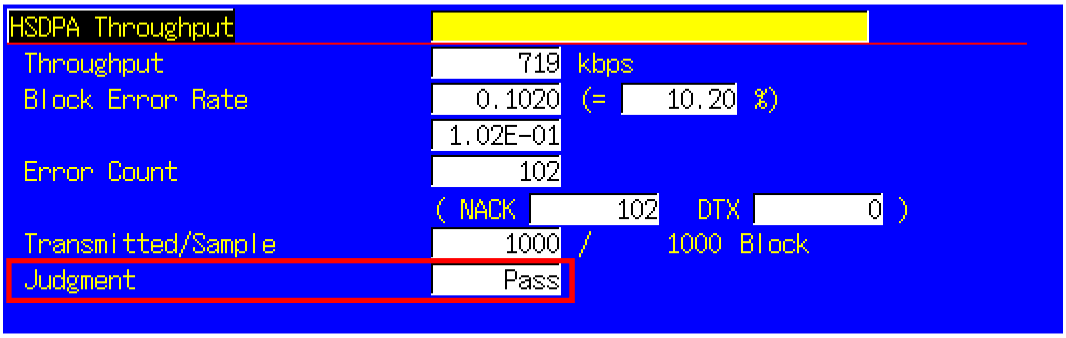


28. Execute **ILVL 35.0** and set Input Level to +35.0dBm.
29. Execute **TPCPAT ALL1** and set TPC Pattern to ALL1.
30. Wait about 100mm seconds until the UE power is the maximum.
31. Execute **SWP** and perform the HS-DPCCH measurement.
32. Execute **TTL_STEP_HSPWR?** and read the result of HS-DPCCH.



6.3A Maximum Input Level for HS-PDSCH Reception (16QAM)

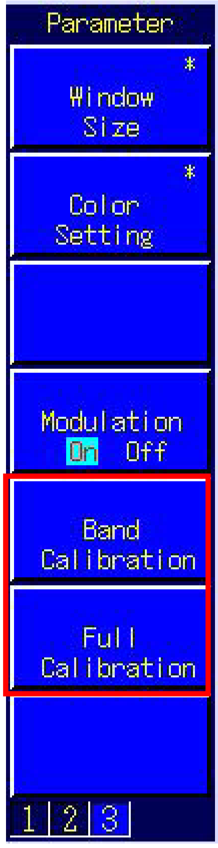
1. Execute **ULGAINPAR 8,15,8,8,8** and set Beta C to 8, Beta D to 15, Delta ACK to 8, Delta NACK to 8, Delta CQI to 8.
2. Execute **TPCALGO 2**and set TPC Algorithm to 2.
3. Connect by Fixed Reference Channel H-Set1(16QAM).
4. Execute **TPCPAT ILPC** and set TPC Pattern to Inner Loop Power Control.
5. Execute **ILVL 20.0** and set Input Level to +20.0dBm.
6. Wait for a while until the UE power gets 20.0dBm.
7. Execute **OLVL -25.7** and set Output Level to –25.7dBm.
8. Execute **DDPCHPWR -13.0** and set DPCH_Ec/Ior to –13.0dB.
9. Execute **HSSCCHPWR -13.0** and set HS-SCCH_Ec/Ior to –13.0dB.
10. Execute **HSPDSCHPWR -3.0** and set HS-PDSCH_Ec/Ior to –3.0dB.
11. Execute **TPUT_MEAS ON** and set the HSDPA Throughput measurement to to On.
12. Execute **TPUT_SAMPLE 1000** and set the count of HSDPA Throuhgh measurement samples to 1000Block.
13. Execute **SWP** and perform the HSDPA Throughput measurement.
14. Execute **TPUTPASS?** and read the result of HSDPA Throughput measurement.



1.12. Others

Calibration

The frequency characteristic of level accuracy to the input and output levels is leveled off and deviation of level accuracy due to the internal temperature variation is calibrated. A single platform of MT8820A can perform Band Calibration (**BANDCAL**) and Full Calibration (**FULLCAL**). Band Calibration is performed in W-CDMA band (UL: 824~849 MHz, 1710~1910 MHz, 1920~1980 MHz, DL: 869~894 MHz, 1805~1990 MHz, 2110~2170 MHz). Full Calibration is performed in input/output band of MT8820A(30~2700 MHz).
Compared with Band Calibration, Full Calibration is time-consuming although it includes the execution contents of Band Calibration. Full Calibration must be performed at turn of the year and after software upgrades. Approx. one-hour of aging is required after power-on.
Band Calibration must be performed at the intervals where temperature variation can be disregarded, for instance, once per measurement of one set of UE.

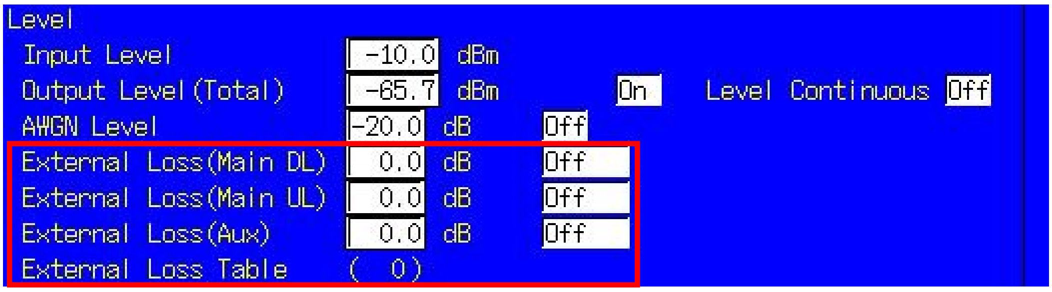


Dynamic Range

MT8820A can assure the measurement performance (linearity) within the range from Input Level to –40dB. Also, overrange level error occurs if the peak value exceeds +10dB from Input Level. Therefore, the Input Level of MT8820A must be set depending on the measurement so that the power measurement value is specified within +5dB~–40dB from Input Level.

External Loss

MT8820A can set External Loss such as cable loss as offset values.
External Loss can be set respectively in Main DL, Main UL and Aux.



For instance, the following steps must be performed to set the loss value of Main DL to 3.0dB, and the loss value of Main UL to 5.0dB.

1. Execute **DLEXTLOSSSW ON** and enable the External Loss of Main DL.
2. Execute **ULEXTLOSSSW ON** and enable the External Loss of Main UL.
3. Execute **DLEXTLOSS 3.0** and set the loss value of Main DL to 3.0dB.
4. Execute **ULEXTLOSS 5.0** and set the loss value of Main UL to 5.0dB.

Above commands set the same loss value to all frequencies. However, as a function limited to GPIB, the loss value can be set to a maximum of 100 frequency points for the External Loss table. This table can be shared in W-CDMA and GSM. Also, a linear interpolated value of loss values at the closest two frequency points specified on the table is set for the frequency whose loss value is not specified on the table.

For instance, the following steps must be performed to set the loss value of Main DL to 3.0dB at the frequency 2140MHz, and the loss value of Main UL to 5.0dB at the frequency 1950MHz.

1. Execute **DLEXTLOSSSW COMMON** and use the common table in External Loss of Main DL.
2. Execute **ULEXTLOSSSW COMMON** and use the common table in External Loss of Main UL.
3. Execute **LOSSTBLVAL 1950MHz, 0.0, 5.0, 0.0** and set the loss value of Main UL to 5.0dB at 1950MHz.
4. Execute **LOSSTBLVAL 2140MHz, 3.0, 0.0, 0.0** and set the loss value of Main DL to 3.0dB at 2140MHz.

The number of frequency points specified on the table is displayed in the External Loss Table on screen. Otherwise, it can be read by executing **LOSSTBLSAMPLE?**. **DELLOSSTBL** must be executed to erase the loss value of all frequency points specified on the table.

Synchronization between a Control PC and a MT8820A

Due to the accumulation of commands in the buffer of MT8820A, it might take some time to actually process commands even if the transmission of commands is completed on the PC side. In this case, MT8820A is able to confirm the completion of command processing by executing queries such as **ESR?** after transmitting commands and keeping these commands waiting in a GPIB driver until the response is returned.

For instance, when reading RSSI value with an UE after changing Output Level of MT8820A as in RSSI measurement in adjustment process, the controlling of MT8820A and reading of measurement value must be synchronized. The following steps must be performed in this case.

1. Set the channel and others.
2. Execute **OLVL -90.0** and set Output Level to –90.0dBm.
3. Execute **ESR?** and wait for the response to be returned.
4. Take the time required for RSSI measurement on the UE side.
5. Acquire RSSI value from an UE.

Also, when controlling Phone1 and Phone2 simultaneously in Parallel Phone Measurement, the processing of one Phone might be kept waiting due to the processing of another Phone. Therefore, it is recommended to program for waiting the response by transmitting queries after transmission of commands.

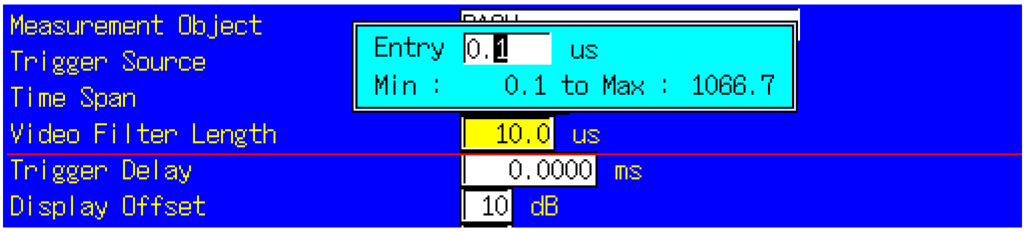
Speedup of Control Software

1. Screen Off

The easiest way to speedup the control software is to turn off the screen of MT8820A. The screen is set to Off by executing **SCREEN OFF**.

1. Setting up of Video Filter Length

When performing measurement in Time Domain Measurement, it can be speeded up by setting “Video Filter Length” to minimum (0.1 μs). The setting value of “Video Filter Length” influences only in the waveform on the screen, not in the result of Slot list measurement.



2. GSM Measurement Software

2.1. Specification

Table 2.1-1 GSM Measurement Software Specification

Item	Specification
Frequency/Modulation measurement	Frequency: 300~2200 MHz Input level: –30~+40 dBm(Average power of burst signal, Main connector) Measurement object: Normal burst, RACH Carrier frequency accuracy: Reference oscillator accuracy +10 Hz (Normal burst measurement) Reference oscillator accuracy +20 Hz (RACH measurement) Residual phase error: ≤0.5° (rms), 2° (peak)
Amplitude measurement	Frequency: 300~2200 MHz Input level: –30~+40 dBm(Average power of burst signal, Main connector) Measurement object: Normal burst, RACH Measurement accuracy: ±0.5 dB (–20~+40 dBm), ±0.7 dB (–30~–20 dBm), after calibration Linearity: ±0.2 dB (0~–40 dB, ≥–30 dBm) Carrier-off power: ≥65 dB(Input level≥–10 dBm) ≥45 dB(Input level≥–30 dBm)
Output RF Spectrum	Frequency: 300~2200 MHz Input level: –10~+40 dBm(Average power of burst signal, Main connector) Measurement object: Normal burst Measurement points: ±100 kHz, ±200 kHz, ±250 kHz, ±400 kHz, ±600 kHz, ±800 kHz, ±1000 kHz, ±1200 kHz, ±1400 kHz, ±1600 kHz, ±1800 kHz, ±2000 kHz Measurement range due to modulation: At an average of 10 times, ≤–55 dB(≤250 kHz offset) ≤–66 dB(≥400 kHz offset) Measurement range due to transition: ≤–57 dB(≥400 kHz offset)
RF signal generator	Output frequency: 300~2200 MHz, Hz step Phase error: ≤1° (rms), 4° (peak) TCH data: PN9, PN15, ALL 0, ALL 1, Fixed(PAT0-PAT9)
Error rate measurement	Function: Measure the error rate of frame, bit and CRC. GSM measurement object: -Loopback data inserted in the uplink TCH -Serial data inputted from the Call Proc. I/O port on a rear panel GPRS measurement object: -The number of blocks received from a terminal and inserted in the uplink TCH. -The number of USF blocks received from a terminal.
Call processing	Call control: Location registration, origination, termination, disconnection from network, disconnection from UE station, GPRS connection, GPRS disconnection, data transfer MS control: Output level, time slot, timing advance, loopback On/Off, GPRS test mode
Channel coding	FS, EFS, HS0, HS1, AFS, AHS0, AHS1, CS-1, CS-2, CS-3, CS-4
Frequency band	GSM450, GSM480, GSM850, P-GSM, E-GSM, R-GSM, DCS1800, PCS1900

Table 2.1-3 EGPRS Measurement Software Option Specification

Item	Specification
Frequency/Modulation measurement	Frequency: 300~2200 MHz Input level: –30~+40 dBm(Average power of burst signal, Main connector) Measurement object: Normal burst (GMSK, 8PSK), RACH Carrier frequency accuracy: Reference oscillator accuracy +10 Hz (Normal burst measurement) Reference oscillator accuracy +20 Hz (RACH measurement) Residual phase error (GMSK): ≤0.5° (rms), 2° (peak) Residual EVM (8PSK): ≤1.5 % (rms)
Amplitude measurement	Frequency: 300~2200 MHz Input level: –30~+40 dBm(Average power of burst signal, Main connector) Measurement object: Normal burst (GMSK, 8PSK), RACH Measurement accuracy: ±0.5 dB (–20~+40 dBm), ±0.7 dB (–30~–20 dBm), after calibration Linearity: ±0.2 dB (0~–40 dB, ≥–30 dBm) Carrier-off power: ≥65 dB(Input level≥–10 dBm) ≥45 dB(Input level≥–30 dBm)
Output RF Spectrum	Frequency: 300~2200 MHz Input level: –10~+40 dBm(Average power of burst signal, Main connector) Measurement object: Normal burst (GMSK, 8PSK) Measurement points: ±100 kHz, ±200 kHz, ±250 kHz, ±400 kHz, ±600 kHz, ±800 kHz, ±1000 kHz, ±1200 kHz, ±1400 kHz, ±1600 kHz, ±1800 kHz, ±2000 kHz Measurement range due to modulation: At an average of 10 times, ≤–55 dB(≤250 kHz offset) ≤–66 dB(≥400 kHz offset) Measurement range due to transition: ≤–57 dB(≥400 kHz offset)
RF signal generator	Output frequency: 300~2200 MHz, 1 Hz step Phase error (GMSK): ≤1° (rms), 4° (peak) Modulation accuracy (8PSK): ≤3% (rms) TCH data: PN9, PN15, ALL 0, ALL 1, Fixed(PAT0-PAT9)
Error rate measurement	Function: Measure the error rate of bit. GSM measurement object: -Loopback data inserted in the uplink TCH EGPRS measurement object: -The number of blocks received from a terminal and inserted in the uplink TCH -The number of USF blocks received from a terminal
Call processing	Call control: Location registration, EGPRS connection, EGPRS disconnection, data transfer MS control: Output level, time slot, timing advance, EPRS test mode
Coding scheme	MCS1, MCS2, MCS3, MCS4, MCS5, MCS6, MCS7, MCS8, MCS9
Puncturing scheme	P1, P2, P3

2.2. 3GPP Measurement Specification Table

TS51.010	Item	comment	
12	**Transceiver**		
12.1	Conducted spurious emissions	Requires SPA	√
12.2	Radiated spurious emissions	Requires SPA	√
12.3	Conducted spurious emissions for MS supporting the R-GSM frequency band	Requires SPA	√
12.4	Radiated spurious emissions for MS supporting the R-GSM frequency band	Requires SPA	√
13	**Transmitter**		
13.1	Frequency error and phase error		√√
13.2	Frequency error under multipath and interference conditions	Requires Fading Simulator	√
13.3	Transmitter output power and burst timing		√√
13.4	Output RF spectrum		√√
13.6	Frequency error and phase error in HSCSD multislot configurations		–
13.7	Transmitter output power and burst timing in HSCSD configurations		–
13.8	Output RF spectrum in HSCSD multislot configuration		–
13.9	Output RF spectrum for MS supporting the R-GSM band		√√
13.16	**GPRS transmitter tests**		
13.16.1	Frequency error and phase error in GPRS multislot configuration		√√
13.16.2	Transmitter output power in GPRS multislot configuration	up to 2UL	√√
13.16.3	Output RF spectrum in GPRS multislot configuration	1UL only	√√
13.17	**EGPRS transmitter tests**	without Call Processing	
13.17.1	Frequency error and Modulation accuracy in EGPRS Configuration		√√
13.17.2	Frequency error under multipath and interference conditions	Requires Fading Simulator	√
13.17.3	EGPRS Transmitter output power	up to 2UL	√√
13.17.4	Output RF spectrum in EGPRS configuration	1UL only	√√

√√: Support | √: Requires external equipment (SPA or SG) | F: Future Support | –: Not Support

TS51.010	Item	comment	
14	**Receiver**		
14.1	**Bad frame indication**		
14.1.1	Bad frame indication - TCH/FS		–
14.1.2	Bad frame indication - TCH/HS		–
14.1.3	Bad frame indication - TCH/FS – Frequency hopping and downlink DTX - Phase 2 MS in a phase 1 network		–
14.1.4	Bad frame indication - TCH/HS – Frequency hopping and downlink DTX - Phase 2 MS in a phase 1 network		–
14.1.5	Bad frame indication - TCH/AFS (Speech frame)		–
14.1.6	Bad frame indication - TCH/AHS		–
14.1.6.1	Bad frame indication - TCH/AHS - Random RF input		–
14.2	**Reference sensitivity**		
14.2.1	Reference sensitivity - TCH/FS	Static conditions	√√
		Propagation conditions (Requires Fading Simulator)	√
14.2.2	Reference sensitivity - TCH/HS (Speech frames)	Propagation conditions (Requires Fading Simulator)	√
14.2.3	Reference sensitivity - FACCH/F		–
14.2.4	Reference sensitivity - FACCH/H		–
14.2.5	Reference sensitivity - full rate data channels		–
14.2.6	Reference sensitivity - half rate data channels		–
14.2.7	Reference sensitivity - TCH/EFS	Static conditions	√√
		Propagation conditions (Requires Fading Simulator)	√
14.2.8	Reference sensitivity - full rate data channels in multislot configuration		–
14.2.9	Reference sensitivity - TCH/FS for MS supporting the R-GSM band	Static conditions	√√
		Propagation conditions (Requires Fading Simulator)	√
14.2.10	Reference sensitivity - TCH/AFS	Static conditions	√√
		Propagation conditions (Requires Fading Simulator)	√
14.2.18	Reference sensitivity - TCH/AHS	Static conditions	√√
		Propagation conditions (Requires Fading Simulator)	√
14.2.19	Reference sensitivity - TCH/AFS-INB		–
14.2.20	Reference sensitivity - TCH/AHS-INB		–
14.3	**Usable receiver input level range**	Static conditions	√√
		Propagation conditions (Requires Fading Simulator)	√

√√: Support | √: Requires external equipment (SPA or SG) | F: Future Support | –: Not Support

TS51.010	Item	comment	
14.4	**Co-channel rejection**		
14.4.1	Co-channel rejection - TCH/FS	Requires Fading Simulator Requires SG	√
14.4.2	Co-channel rejection - TCH/HS	Requires Fading Simulator Requires SG	√
14.4.3	Co-channel rejection - TCH/HS (SID frames)		–
14.4.4	Co-channel rejection – FACCH/F		–
14.4.5	Co-channel rejection – FACCH/H		–
14.4.6	Co-channel rejection - TCH/EFS	Requires Fading Simulator Requires SG	√
14.4.7	Receiver performance in the case of frequency hopping and co-channel interference on one carrier		–
14.4.8	Co-channel rejection - TCH/AFS	Requires Fading Simulator Requires SG	√
14.4.16	Co-channel rejection - TCH/AHS	Requires Fading Simulator Requires SG	√
14.4.17	Co-channel rejection - TCH/AFS-INB		–
14.4.18	Co-channel rejection - TCH/AHS-INB		–
14.5	**Adjacent channel rejection**		
14.5.1	Adjacent channel rejection – speech channels	Requires Fading Simulator Requires SG	√
14.5.2	Adjacent channel rejection – control channels		–
14.6	**Intermodulation rejection** (+800kHz unwanted CW signals transmit) (+1600kHz unwanted Mod. signals transmit)		
14.6.1	Intermodulation rejection – speech channels	Requires SG	√
14.6.2	Intermodulation rejection – control channels		–
14.7	**Blocking and spurious response**		
14.7.1	Blocking and spurious response – speech channels	Requires SG	√
14.7.2	Blocking and spurious response – control channels		–
14.7.3	Blocking and spurious response – speech channels for MS supporting the R-GSM band	Requires SG	√
14.7.4	Blocking and spurious response – control channels for MS supporting the R-GSM band		–
14.8	**AM suppression**		
14.8.1	AM suppression - speech channels	Requires External SG	√
14.8.2	AM suppression - control channels		–
14.9	Paging performance at high input levels		–
14.10	**Performance of the Codec Mode Request Generation for Adaptive Multi-Rate Codecs**		
14.10.1	Performance of the Codec Mode Request Generation – TCH/AFS		–
14.10.2	Performance of the Codec Mode Request Generation – TCH/AHS		–
14.16	**GPRS receiver tests**		
14.16.1	Minimum Input level for Reference Performance	Static conditions	√√
		Propagation conditions (Requires Fading Simulator)	√
14.16.2	**Co-channel rejection**		
14.16.2.1	Co-channel rejection for packet channels	Static conditions	√√
		Propagation conditions (Requires Fading Simulator)	√
14.16.3	Acknowledged mode / Downlink TBF / I_LEVEL measurement report		–

√√: Support | √: Requires external equipment (SPA or SG) | F: Future Support | –: Not Support

TS51.010	Item	comment	
14.18	**EGPRS receiver tests**		
14.18.1	Minimum Input level for Reference Performance	Static conditions	√√
		Propagation conditions (Requires Fading Simulator)	√
14.18.2	Co-channel rejection	Static conditions (Requires SG)	√
		Propagation conditions (Requires SG and Fading Simulator)	√
14.18.3	Adjacent channel rejection	Static conditions (Requires SG)	√
		Propagation conditions (Requires SG and Fading Simulator)	√
14.18.4	Intermodulation rejection	Static conditions (Requires SG)	√
		Propagation conditions (Requires SG and Fading Simulator)	√
14.18.5	Blocking and spurious response	Requires SG	√
14.18.6	EGPRS Usable receiver input level range	Static conditions	√√
		Propagation conditions (Requires Fading Simulator)	√
14.18.7	Incremental Redundancy Performance		–

√√: Support | √: Requires external equipment (SPA or SG) | F: Future Support | –: Not Support

2.3. TRX Measurement(GSM)

Connection in GSM

Measurement is performed by connecting a MS in the Loopback state. The connection procedures are below.

1. Execute **PRESET** and set the default parameter.
2. Turn on the power of a MS.
3. Execute **CALLRSLT? 4** and wait for the response to turn 1(Registration).
4. Execute **CALLSTAT?** and wait for the response to turn 1(=Idle(Regist)).
5. Execute **CALLSA** and connect to Voice Call.
6. Execute **CALLSTAT?** and wait for the response to turn 7(=Communication).
7. Execute **LOOPBACK ON** and set the MS to the Loopback state.

Disconnection in GSM

1. Execute **LOOPBACK OFF** and set a MS to the normal connection state.
2. Execute **CALLSO** and disconnect from Voice Call.
3. Execute **CALLSTAT?** and wait for the response to turn 2(=Idle(Regist)).

Change of TCH Channel and MS Power Level by Handover

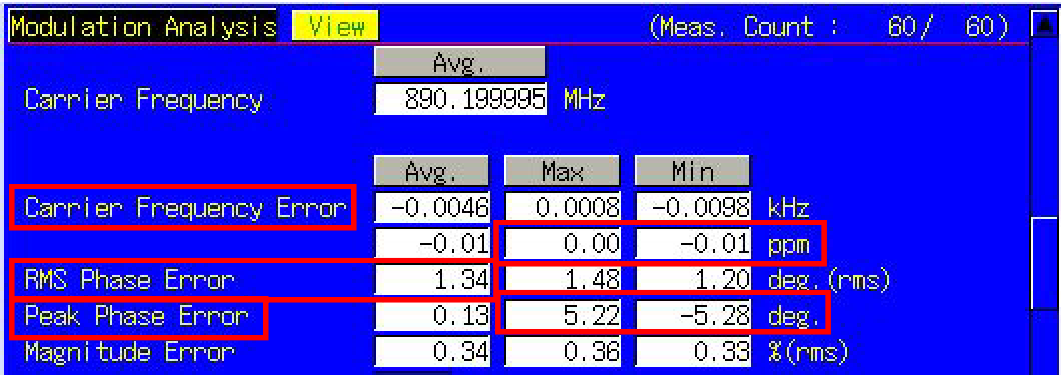
TRX measurement is normally performed at three frequency points; L,M and H. Also, TX measurement is performed at three power levels; L,M and H. Switching of TCH Channel and MS Power Level by handover enables to perform high-speed measurement without the need of reconnection. Output Level must be set a little higher when performing handover so that it won't fail. Also, GPIB command, which is transmitted during handover, stands by until the handover is terminated.

1. Execute **CHMSPWR 1,5**, change TCH Channel to 1 and MS Power Level to 5.
2. Perform TRX measurement.
3. Execute **CHMSPWR 1,12**, change TCH Channel to 1 and MS Power Level to 12.
4. Perform TX measurement.
5. Execute **CHMSPWR 1,19**, change TCH Channel to 1 and MS Power Level to 19.
6. Perform TX measurement.
7. Execute **CHMSPWR 63,5**, change TCH Channel to 63 and MS Power Level to 5.
8. Perform TRX measurement.
9. Execute **CHMSPWR 63,12**, change TCH Channel to 63 and MS Power Level to 12.
10. Perform TX measurement.
11. Execute **CHMSPWR 127,19**, change TCH Channel to 63 and MS Power Level to 19.
12. Perform TX measurement.
13. Execute **CHMSPWR 127,5**, change TCH Channel to 127 and MS Power Level to 5.
14. Perform TRX measurement.
15. Execute **CHMSPWR 127,12**, change TCH Channel to 127 and MS Power Level to 12.
16. Perform TX measurement.
17. Execute **CHMSPWR 127,19**, change TCH Channel to 127 and MS Power Level to 19.
18. Perform TX measurement.

13.1 Frequency error and phase error

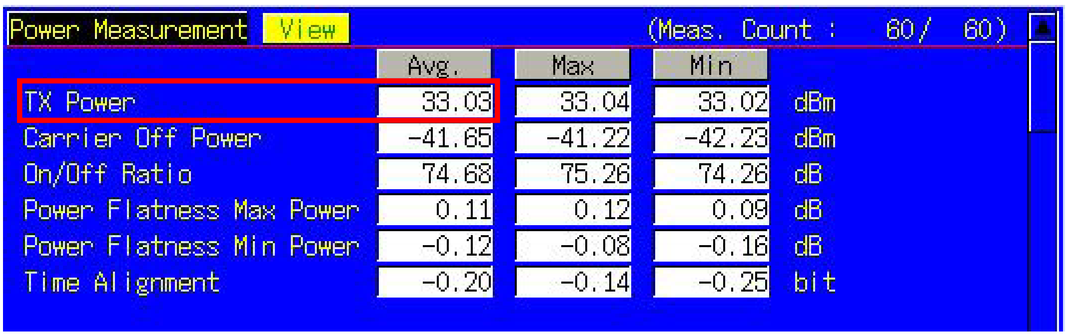
1. Connect to Loopback.
2. Execute **MOD_MEAS ON** and set Modulation Analysis measurement to On.
3. Execute **MOD_COUNT 60** and set the average count of Modulation Analysis measurement to 60 times.
4. Execute **SWP** and perform Modulation Analysis measurement.
5. Execute **MAX_CARRFERR? PPM** and read the result of Frequency Error measurement.
6. Execute **MIN_CARRFERR? PPM** and read the result of Frequency Error measurement.
7. Execute **AVG_PHASEERR?** and read the result of RMS Phase Error measurement.
8. Execute **MAX_PPHASEERR?** and read the result of Peak Phase Error measurement.
9. Execute **MIN_PPHASEERR?** and read the result of Peak Phase Error measurement.

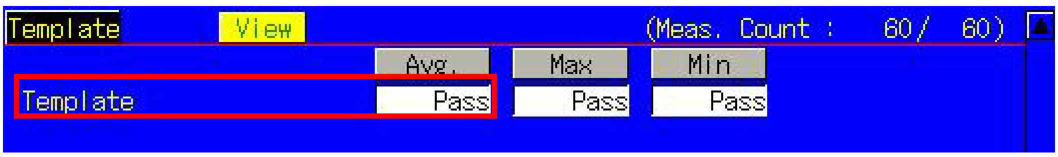
Max and Min measurement results must be used for signed measurement such as Frequency Error.



13.3 Transmitter output power and burst timing

1. Connect to Loopback.
2. Execute **PWR_MEAS ON** and set Power measurement to On.
3. Execute **TEMP_MEAS ON** and set Template measurement to On.
4. Execute **PWR_COUNT 60** and set the average count of Power measurement to 60 times.
5. Execute **PWR_TEMPSTD** and set the values that correspond to Channel and MS Power Level to the specified Template.
6. Execute **SWP** and perform Power measurement.
7. Execute **AVG_TXPWR?** and read the result of Power measurement.
8. Execute **AVG_PWRTEMP?** and read the result of Template judgment.





13.4 Output RF spectrum

1. Connect to Loopback.
2. Execute **ORFSMD_MEAS ON** and set ORFS Modulation measurement to On.
3. Execute **ORFSSW_MEAS ON** and set ORFS Switching measurement to On.
4. Execute **ORFSMD_COUNT 60** and set the average count of ORFS Modulation measurement to 60 times.
5. Execute **ORFSSW_COUNT 60** and set the average count of ORFS Switching measurement to 60 times.
6. Execute **SWP** and perform ORFS measurement.
7. Execute **ORFSMD_JUDGE?** and read the judgment result of ORFS Modulation.
8. Execute **AVG LMODPWR ?OF100** and read the judgment result of ORFS Switching.
9. Execute **AVG UMODPWR ?OF100** and read the judgment result of ORFS Switching.
10. Execute **ORFSSW JUDGE ?** and read the judgement result of ORFS Switching.
11. Esecute **MAX LSWPWR ?OF100** and read the judgment result of ORFS Switching (Frequency Offset –100kHz).
12. Esecute **MAX USWPWR ?OF100** and read the judgment result of ORFS Switching (Frequency Offset –100kHz).

Output RF Spectrum - Modulation View (Meas. Count : 60/ 60)

Judgement Pass

	Lower			Upper			
kHz	Avg.	Max	Min	Avg.	Max	Min	
0	25.57	27.68	22.68	25.57	27.68	22.68	dBm
100	-8.89	-5.74	-13.44	-9.80	-4.97	-14.21	dB
200	-35.95	-33.23	-42.73	-36.12	-33.58	-38.66	dB
250	-41.54	-39.12	-44.14	-41.24	-38.16	-44.13	dB
400	-66.20	-61.92	-70.95	-66.85	-62.37	-72.92	dB
600	-73.84	-69.17	-79.36	-73.97	-68.49	-82.20	dB
800	-77.44	-72.19	-81.98	-77.19	-72.66	-81.29	dB
1000	-77.78	-73.56	-82.79	-78.30	-74.88	-83.73	dB
1200	-78.79	-74.32	-83.26	-79.38	-76.24	-85.10	dB
1400	-78.81	-72.94	-84.00	-79.56	-75.88	-85.01	dB
1600	-79.76	-75.89	-84.73	-80.36	-76.31	-85.15	dB
1800	-72.64	-68.50	-76.08	-73.82	-70.51	-77.10	dB
2000	-73.16	-69.82	-76.11	-74.05	-70.20	-77.41	dB

Output RF Spectrum - Switching View (Meas. Count : 60/ 60)

Judgement Pass

	Lower			Upper			
kHz	Avg.	Max	Min	Avg.	Max	Min	
0	31.46	32.51	30.43	31.46	32.51	30.43	dBm
100	24.63	25.33	23.45	24.47	25.45	22.20	dBm
200	-2.35	-0.80	-4.47	-1.73	-0.26	-3.23	dBm
250	-9.97	-8.81	-11.34	-9.73	-8.22	-10.88	dBm
400	-32.67	-29.25	-36.37	-31.64	-29.24	-33.88	dBm
600	-38.35	-36.32	-40.75	-36.88	-35.54	-38.58	dBm
800	-41.42	-38.24	-43.78	-39.90	-37.87	-41.87	dBm
1000	-42.41	-40.52	-44.78	-41.93	-39.46	-44.99	dBm
1200	-44.38	-41.97	-46.82	-44.15	-41.79	-47.35	dBm
1400	-44.84	-41.69	-47.55	-45.04	-43.17	-48.12	dBm
1600	-45.99	-43.66	-48.39	-45.97	-43.85	-47.96	dBm
1800	-46.13	-42.75	-49.09	-46.69	-43.54	-50.12	dBm
2000	-46.44	-43.68	-49.48	-47.16	-44.11	-49.78	dBm

14.2.1 Reference sensitivity – TCH/FS

1. Connect to Loopback.
2. Execute **LBTYPE FAST** and set Loopback Type to C.
3. Execute **BER_MEAS ON** and set BER measurement to On.
4. Execute **BER_SAMPLE FAST,10000** and set the number of BER measurement samples to 10000 bits.
5. Execute **OLVL -104.0** and set Output Level to –104.0dBm.
6. Execute **SWP** and perform BER measurement.
7. Execute **BER?** and read the result of BER measurement.

Reduction of measurement time by batch processing

Above TRX test items can be measured under the same measurement parameter. Measurement time can be reduced by batch processing of all items.

1. Connect to Loopback.
2. Execute **LBTYPE FAST** and set Loopback Type to C.
3. Execute **PWR_TEMPSTD** and set the values that correspond to Channel and MS Power Level to the specified Template.
4. Execute **ALLMEASITEMS ON,OFF,60,ON,OFF,ON,OFF,ON,OFF,60,ON,OFF,60,ON,OFF,60,ON,OFF**.
   Set all items to On and Average Count to 60 times.
5. Execute **BER_SAMPLE FAST,10000** and set the number of BER measurement samples to 10000 bits.
6. Execute **OLVL -104.0** and set Output Level to –104.0dBm.
7. Execute **SWP** and perform the measurement.
8. Execute **AVG_TXPWR?**,etc. and read the measurement result.

2.4. Connection in GPRS

Attach (location registration) of GPRS is required for GPRS testing.
In completion of Attach, the call processing state of this measuring instrument turns Attached state.

Attach procedures

1. Execute **PRESET** and set the default parameter.
2. Execute **OPEMODE GPRS** and set Operating Mode to GPRS.
3. Turn on the power of a MS.
4. Execute **CALLSTAT?** and wait until the status turns 13(= Attached).
   (*)Some of MS might not be Attached only by power-on. Confirm the setting of MS in this case.

Connection Type

Either of the following connection methods is selected when performing TX/RX measurement of GPRS.
TX measurement: Test Mode A or Test Mode B (3GPP recommends TestModeA.)
RX measurement: BLER

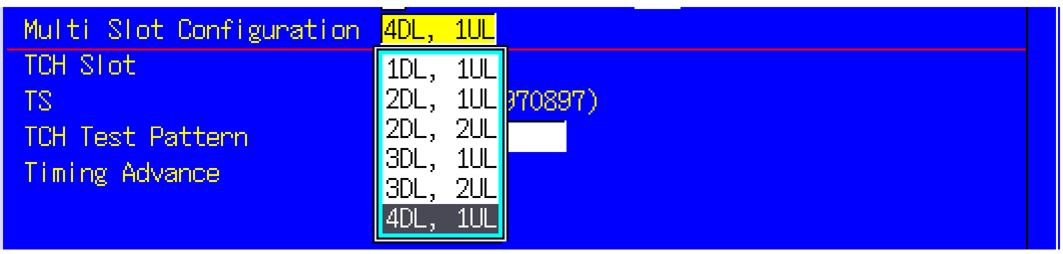
Multi Slot setting

The slots used in Multi Slot Configration is specified for the setting of Multi Slot(connection by multiple Slots).
The number of available slots is limited depending on the Multi Slot Class of a MS. Refer to Table 2.4-1 for the relationship between Multi Slot Class and the number of available slots. This measuring instrument supports the setting of Class1~10 except Class 7.
Multi Slot Class of a MS can be confirmed on the MS Report screen after completing Attach procedures described in 2.4.1.

Table 2.4-1

Multislot class	Maximum number of slots		
	Rx	Tx	Sum
1	1	1	2
2	2	1	3
3	2	2	3
4	3	1	4
5	2	2	4
6	3	2	4
7	3	3	4
8	4	1	5
9	3	2	5
10	4	2	5

RX : Maximum number of slots in one frame that can be received by a MS.
(Described with DL in this measuring instrument.)
TX : Maximum number of slots in one frame that can be transmitted by a MS.
(Described with UL in this measuring instrument.)
SUM : Maximum number of slots that can be transmitted/received simultaneously combining the number of slots in RX and TX.



TX measurement is performed with the setting of the maximum number of slots that can be transmitted by a MS.
RX measurement is performed with the setting of the maximum number of slots that can be received by a MS.

Change of TCH Channel, MS Power Level and CS(Coding Scheme) by Handover

TX/RX measurement is normally performed at three frequency points; L,M and H. Also, TX measurement is performed by arbitrarily changing the power level of each slot and RX measurement is performed by changing CS. Switching of TCH Channel, MS Power Level and CS by handover enables to perform high-speed measurement without the need of reconnection. Output Level must be set a little higher when performing handover so that it won't fail. Also, GPIB command, which is transmitted during handover, stands by until the handover is terminated.

[TX measurement]

1. Execute **CHMSPWR 1,5,5**, change TCH Channel to 1, MS Power Level of 1st Slot to 5 and MS Power Level of 2ndSlot to 5.
2. Perform TX measurement.
3. Execute **CHMSPWR 1,19,5**, change TCH Channel to 1, MS Power Level of 1st Slot to 19 and MS Power Level of 2ndSlot to 5.
4. Perform TX measurement.
5. Execute **CHMSPWR 1,5,19**, change TCH Channel to 1, MS Power Level of 1st Slot to 5 and MS Power Level of 2ndSlot to 19.
6. Perform TX measurement.
7. Execute **CHMSPWR 63,5,5**, change TCH Channel to 63, MS Power Level of 1st Slot to 5 and MS Power Level of 2ndSlot to 5.
8. Perform TX measurement.
9. Execute **CHMSPWR 63,19,5**, change TCH Channel to 63, MS Power Level of 1st Slot to 19 and MS Power Level of 2ndSlot to 5.
10. Perform TX measurement.
11. Execute **CHMSPWR 63,5,19**, change TCH Channel to 63, MS Power Level of 1st Slot to 5 and MS Power Level of 2ndSlot to 19.
12. Perform TX measurement.
13. Execute **CHMSPWR 127,5,5**, change TCH Channel to 127, MS Power Level of 1st Slot to 5 and MS Power Level of 2ndSlot to 5.
14. Perform TX measurement.
15. Execute **CHMSPWR 127,19,5**, change TCH Channel to 127, MS Power Level of 1st Slot to 19 and MS Power Level of 2ndSlot to 5.
16. Perform TX measurement.
17. Execute **CHMSPWR 127,5,19**, change TCH Channel to 127, MS Power Level of 1st Slot to 5 and MS Power Level of 2ndSlot to 19.
18. Perform TX measurement.

[RX measurement]

1. Execute **CHMSPWR 1,5**, change TCH Channel to 1 and MS Power Level to 5.
2. Execute **CS CS3** change Coding Scheme to CS3.
3. Perform RX measurement.
4. Execute **CS CS4** change Coding Scheme to CS4.
5. Perform RX measurement.
6. Execute **CHMSPWR 63,5**, change TCH Channel to 63 and MS Power Level to 5.
7. Execute **CS CS3** and change Coding Scheme to CS3.
8. Perform RX measurement.
9. Execute **CS CS4** and change Coding Scheme to CS4.
10. Perform RX measurement.
11. Execute **CHMSPWR 127,5**, change TCH Channel to 127 and MS Power Level to 5.
12. Execute **CS CS3** and change Coding Scheme to CS3.
13. Perform RX measurement.
14. Execute **CS CS4** and change Coding Scheme to CS4.
15. Perform RX measurement.

2.5. TX Measurement (GPRS)

TX two slots are measured by connecting a MS in Test Mode A. The connection is performed according to the following procedures.

Connection in Test Mode A

The following steps must be performed in the state MS completes Attach (Refer to 2.4.1 Attach procedures).

1. Execute **CONNTYPE MODEA** and set Connection Type to Test Mode A.
2. Execute **MLTSLTCFG 2DL2UL** and set Multi Slot Configration to 2Slot for Downlink and Uplink.
3. Execute **CALLSA** and connect to Test Mode A.
4. Execute **CALLSTAT?** and wait for the response to turn 14 (= Transfer).

Disconnection in Test Mode A

In the connection of Test Mode A and Test Mode B, communication is automatically disconnected from MS side when the transmission of data specified in Number of PDUs for Test Mode is completed. Therefore, connection status must be confirmed before disconnection.

1. Execute **CALLSTAT?** and confirm that the status response is 14(=Transfer). If it is 13(=Attached), it has already been disconnected.
2. Execute **CALLSO** and disconnect from Test Mode.
3. Execute **CALLSTAT?** and wait for the response to turn 13(=Attached).

13.16.1 Frequency error and phase error in GPRS multislot configuration

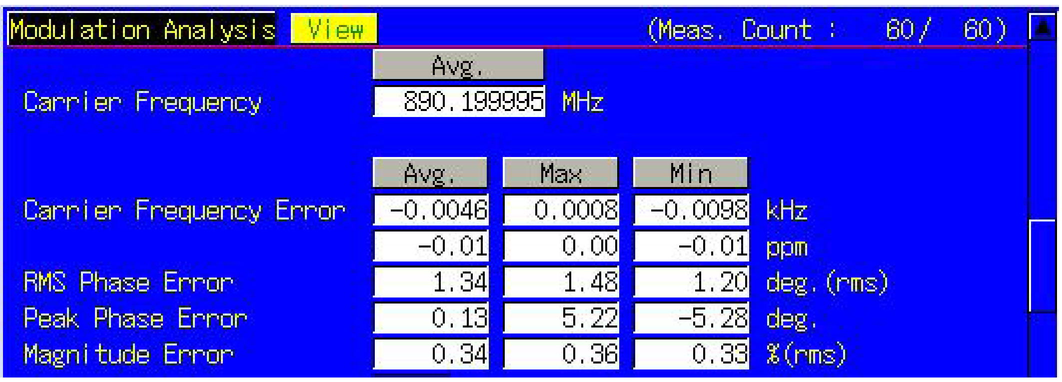
1. Connect to Test Mode A.
2. Execute **MOD_MEAS ON** and set Modulation Analysis measurement to ON.
3. Execute **MOD_COUNT 60** and set the average count of Modulation Analysis measurement to 60 times.

[Measurement of 1st slot]

4. Execute **ILVLCTRL_REF TCH** and set Input Level Control Reference to TCH.
5. Execute **MEASSLOT 2** and set measured slot to Slot 2.
6. Execute **SWP** and perform Modulation Analysis measurement.
7. Execute **MAX_CARRFERR? PPM**, **MIN_CARRFERR? PPM** and read the result of Frequency Error measurement.
8. Execute **AVG_PHASEERR?** and read the result of RMS Phase Error measurement.
9. Execute **MAX_PPHASEERR?**, **MIN_PPHASEERR?** and read the result of Peak Phase Error measurement.

[Measurement of 2nd slot]

10. Execute **ILVLCTRL_REF TCH_2ND** and set Input Level Control Reference to TCH_2nd.
11. Execute **MEASSLOT 3** and set measured slot to Slot 3.
12. Repeat the procedures 6,7,8 and 9.



13.16.2 Transmitter output power in GPRS multislot configuration

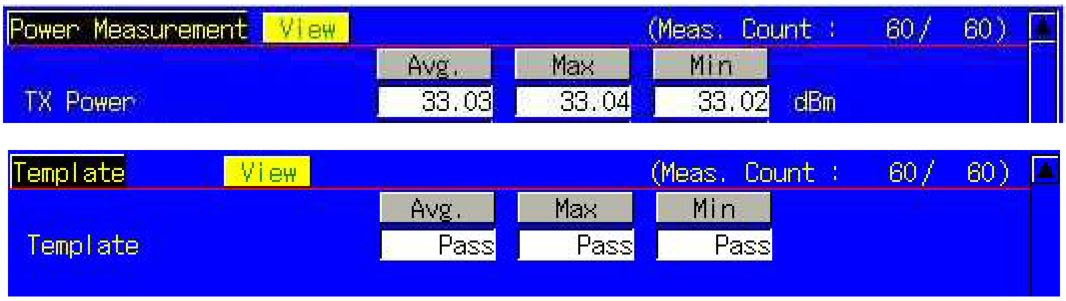
1. Connect to Test Mode A.
2. Execute **PWR_MEAS ON** and set Power measurement to On.
3. Execute **TEMP_MEAS ON** and set Template measurement to On.
4. Execute **PWR_COUNT 60** and set the average count of Power measurement to 60 times.

[Measurement of 1st slot]

5. Execute **ILVLCTRL_REF TCH** and set Input Level Control Reference to TCH.
6. Execute **MEASSLOT 2** and set measured slot to Slot 2.
7. Execute **PWR_TEMPSTD** and set the values that correspond to Channel and MS Power Level for the specified template.
8. Execute **SWP** and perform Power measurement.
9. Execute **AVG_TXPWR?** and read the result of Power measurement.
10. Execute **AVG_PWRTEMP?** and read the result of Template judgment.

[Measurement of 2nd slot]

11. Execute **ILVLCTRL_REF TCH_2ND** and set Input Level Control Reference to TCH_2nd.
12. Execute **MEASSLOT 3** and set measured slot to Slot 3.
13. Repeat the procedures 7,8,9 and 10.



13.16.3 Output RF spectrum in GPRS multislot configuration

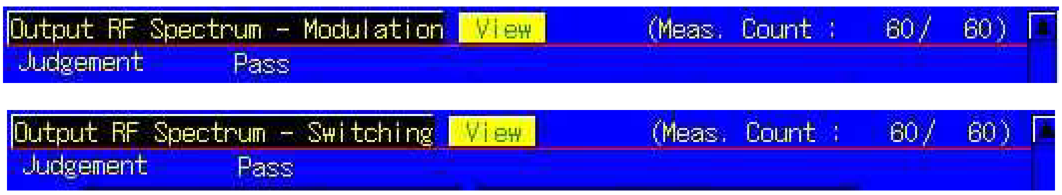
1. Connect to Test Mode A.
2. Execute **ORFSMD_MEAS ON** and set ORFS Modulation measurement to On.
3. Execute **ORFSSW_MEAS ON** and set ORFS Switching measurement to On.
4. Execute **ORFSMD_COUNT 60** and set the average count of ORFS Modulation measurement to 60 times.
5. Execute **ORFSSW_COUNT 60** and set the average count of ORFS Switching measurement to 60 times.

[Measurement of 1st slot]

6. Execute **ILVLCTRL_REF TCH** and set Input Level Control Reference to TCH.
7. Execute **MEASSLOT 2** and set measured slot to Slot 2.
8. Execute **SWP** and perform ORFS measurement.
9. Execute **ORFSMD_JUDGE?** and read the judgment result of ORFS Modulation.
10. Execute **ORFSSW_JUDGE?** and read the judgment result of ORFS Switching.

[Measurement of 2nd slot]

11. Execute **ILVLCTRL_REF TCH_2ND** and set Input Level Control Reference to TCH_2nd.
12. Execute **MEASSLOT 3** and set measured slot to Slot 2.
13. Repeat the procedures 8,9 and 10.



2.6. RX Measurement (GPRS)

RX four slots are measured by connecting a MS in BLER. The connection is performed according to the following procedures.

Connection in BLER

The following steps must be performed in the state MS completes Attach (Refer to 2.4.1 Attach procedures).

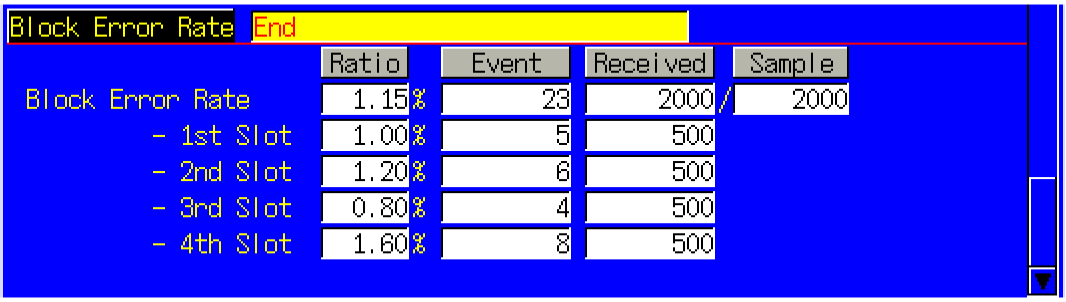
1. Execute **CONNTYPE BLER** and set Connection Type to BLER.
2. Execute **MLTSLTCFG 4DL1UL** and set Multi Slot Configration to 4Slot(Downlink) and 1Slot(Uplink).
3. Execute **CALLSA** and connect to BLER.
4. Execute **CALLSTAT?** and wait for the response to turn 14(= Transfer).

Disconnection in BLER

1. Execute **CALLSO** and disconnect from Test Mode.
2. Execute **CALLSTAT?** and wait for the response to turn 13(=Attached).

14.16.1 Minimum Input level for Reference Performance

1. Connect to BLER.
2. Execute **BLER_MEAS ON** and set BLER measurement to ON.
3. Execute **BLER_SAMPLE 2000** and set the number of BLER measurement samples to 2000 blocks.
4. Execute **OLVL -104.0** and set Output Level to –104.0dBm.
5. Execute **SWP** and perform BLER measurement.
6. Execute **BLER?** and read the result of BLER measurement.



2.7. Connection in EGPRS

Attach (location registration) of EGPRS is required for EGPRS testing.

Attach procedures

1. Execute **PRESET** and set the default parameter.
2. Execute **OPEMODE EGPRS** and set Operating Mode to EGPRS.
3. Turn on the power of a MS.
4. Execute **CALLSTAT?** and wait until the status turns 13(= Attached).
   (*) Some of MS might not be Attached only by power-on. Confirm the setting of MS in this case.

Connection Type

Either of the following connection methods is selected when performing TX/RX measurement of EGPRS.

TX measurement: Test Mode A
RX measurement: BLER,SRB Loop Back

Multi Slot setting

Refer to 2.4.3.

Change of TCH Channel, MS Power Level and CS(Coding Scheme) by Handover

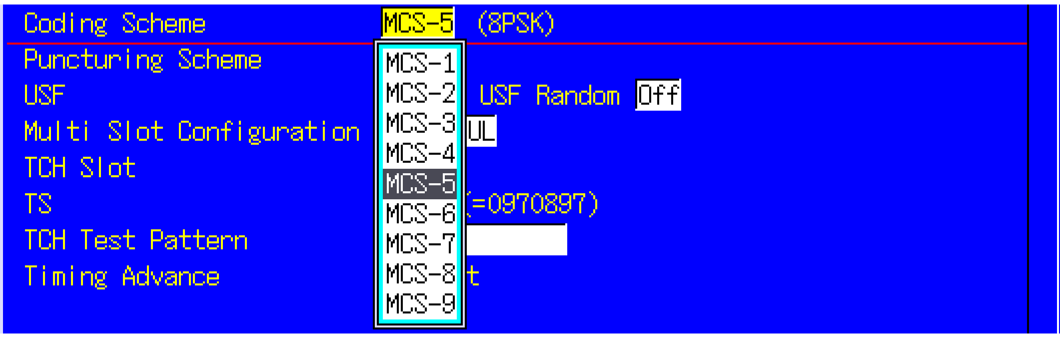
Refer to 2.4.4

GMSK Modulation and 8PSK Modulation

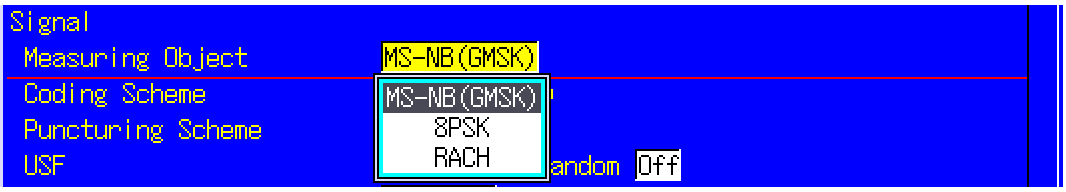
In EGPRS, modulation type depends on the Coding Scheme.

Table 2.7-1 Modulation methof for Coding Scheme

Coding Scheme	Modulation
MCS-9	8PSK
MCS-8	
MCS-7	
MCS-6	
MCS-5	
MCS-4	GMSK
MCS-3	
MCS-2	
MCS-1	



When performing TX measurement, Measuring Object is set to 8PSK or GMSK depending on the modulation type.



2.8. TX Measurement (EGPRS)

TX two slots (Coding Scheme: MCS-5) are measured by connecting a MS in Test Mode A. The connection is performed according to the following procedures.

Connection in Test Mode A

The following steps must be performed in the state MS completes Attach (Refer to 2.7.1 Attach procedures).

1. Execute **CONNTYPE MODEA** and set Connection Type to Test Mode A.
2. Execute **MLTSLTCFG 2DL2UL** and set Multi Slot Configration to 2Slot for Downlink and Uplink.
3. Execute **CS MCS5** and set Coding Scheme to MCS5.
4. Execute **CALLSA** and connect to Test Mode A.
5. Execute **CALLSTAT?** and wait for the response to turn 14 (= Transfer).

Disconnection in Test Mode A

In the connection of Test Mode A and Test Mode B, communication is automatically disconnected from MS side when the transmission of data specified in Number of PDUs for Test Mode is completed. Therefore, connection status must be confirmed before disconnection.

1. Execute **CALLSTAT?** and confirm that the response is 14(=Transfer). If it is 13(=Attached), it has already been disconnected.
2. Execute **CALLSO** and disconnect from Test Mode A.
3. Execute **CALLSTAT?** and wait for the response to turn 13(=Attached).

13.17.1 Frequency error and Modulation accuracy in EGPRS Configuration

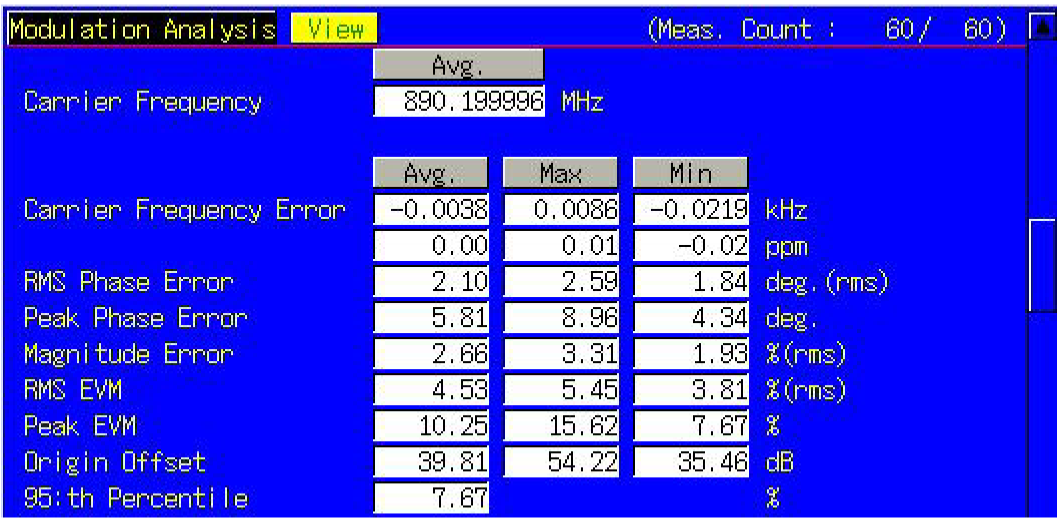
1. Connect to Test Mode A.
2. Execute **MEASOBJ 8PSK** and set Measuring Object to 8PSK.
3. Execute **MOD_MEAS_ON** and set Modulation Analysis measurement to ON.
4. Execute **MOD_COUNT 60** and set the average count of Modulation Analysis measurement to 60 times.

[Measurement of 1st slot]

5. Execute **ILVLCTRL_REF TCH** and set Input Level Control Reference to TCH.
6. Execute **MEASSLOT 2** and set measured slot to Slot 2.
7. Execute **SWP** and perform Modulation Analysis measurement.
8. Execute **AVG_CARRFERR? PPM** and read the result of Frequency Error measurement.
9. Execute **AVG_EVM?** and read the result of RMS EVM measurement.
10. Execute **MAX_PEVM?** and read the result of Peak EVM measurement.
11. Execute **EVM95PCT?** and read the result of 95:th-percentile measurement.
12. Execute **MAX_ORGNOFS?** and read the result of Origin Offset measurement.

[Measurement of 2nd slot]

13. Execute **ILVLCTRL_REF TCH_2ND** and set Input Level Control Reference to TCH_2nd.
14. Execute **MEASSLOT 3** and set measured slot to Slot 3.
15. Repeat the procedures 7~12.



13.17.3 EGPRS Transmitter output power

1. Connect to Test Mode A.
2. Execute **MEASOBJ 8PSK** and set Measuring Object to 8PSK.
3. Execute **PWR_MEAS ON** and set Power measurement to On.
4. Execute **TEMP_MEAS ON** and set Template measurement to On.
5. Execute **PWR_COUNT 60** and set the average count of Power measurement to 60 times.

[Measurement of 1st slot]

6. Execute **ILVLCTRL_REF TCH** and set Input Level Control Reference to TCH.
7. Execute **MEASSLOT 2** and set measured slot to Slot 2.
8. Execute **PWR_TEMPSTD** and set the values that correspond to Channel and MS Power Level for the specified template.
9. Execute **SWP** and perform Power measurement.
10. Execute **AVG_TXPWR?** and read the result of Power measurement.
11. Execute **AVG_PWRTEMP?** and read the result of Template judgment.

[Measurement of 2nd slot]

12. Execute **ILVLCTRL_REF TCH_2ND** and set Input Level Control Reference to TCH_2nd.
13. Execute **MEASSLOT 3** and set measured slot to Slot 3.
14. Repeat the procedures 8,9,10 and 11.

13.17.4 Output RF spectrum in EGPRS configuration

1. Connect to Test Mode A.
2. Execute **MEASOBJ 8PSK** and set Measuring Object to 8PSK.
3. Execute **ORFSMD_MEAS ON** and set ORFS Modulation measurement to On.
4. Execute **ORFSSW_MEAS ON** and set ORFS Switching measurement to On.
5. Execute **ORFSMD_COUNT 60** and set the average count of ORFS Modulation measurement to 60 times.
6. Execute **ORFSSW_COUNT 60** and set the average count of ORFS Switching measurement to 60 times.

[Measurement of 1st slot]

7. Execute **ILVLCTRL_REF TCH** and set Input Level Control Reference to TCH.
8. Execute **MEASSLOT 2** and set measured slot to Slot 2.
9. Execute **SWP** and perform ORFS measurement.
10. Execute **ORFSMD_JUDGE?** and read the judgment result of ORFS Modulation.
11. Execute **ORFSSW_JUDGE?** and read the judgment result of ORFS Switching.

[Measurement of 2nd slot]

12. Execute **ILVLCTRL_REF TCH** and set Input Level Control Reference to TCH.
13. Execute **MEASSLOT 3** and set measured slot to Slot 2.
14. Repeat the procedures 8,9 and 10.

2.9. RX Measurement (EGPRS)

RX four slots are measured by connecting a MS in BLER. The connection is performed according to the following procedures.

Connection in BLER

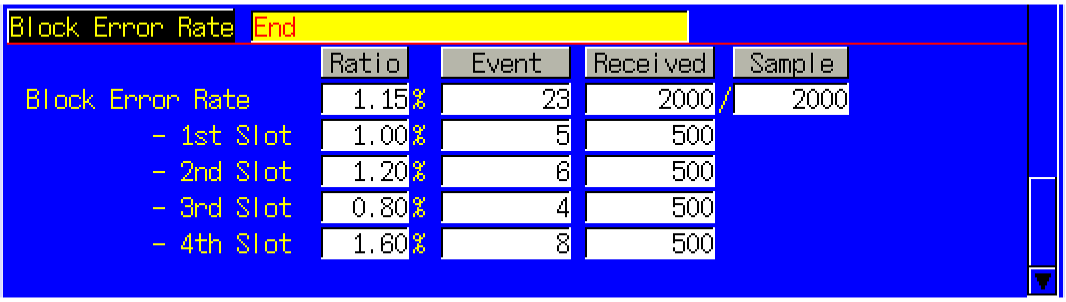
The following steps must be performed in the state MS completes Attach (Refer to 2.7.1 Attach procedures).
1. Execute **CONNTYPE BLER** and set Connection Type to BLER.
2. Execute **MLTSLTCFG 4DL1UL** and set Multi Slot Configration to 4Slot(Downlink) and 1Slot(Uplink).
3. Execute **CALLSA** and connect to BLER.
4. Execute **CALLSTAT?** and wait until the status turns 14(= Transfer).

Disconnection in BLER

1. Execute **CALLSO** and disconnect from Test Mode.
2. Execute **CALLSTAT?** and wait until the status turns 13(=Attached).

14.18.1 Minimum Input level for Reference Performance

1. Execute **BLER** and perform connection.
2. Execute **BLER_MEAS ON** and set BLER measurement to ON.
3. Execute **BLER_SAMPLE 2000** and set the number of BLER measurement samples to 2000 blocks.
4. Execute **OLVL -104.0** and set Output Level to –104.0dBm.
5. Execute **SWP** and perform BLER measurement.
6. Execute **BLER?** and read the result of BLER measurement.



2.10. MS Report

Measurement Report that is regularly submitted from a MS can be read.

1. Connect to a MS.
2. Execute **CALLREP?** and read Flag, RX Level and RX Quality.
   If Flag is 1, RX Level and RX Quality are valid values that are reported from a MS.
   If Flag is 0, RX Level and RX Quality are invalid values that are not updated by MS report. Read the values repeatedly until Flag turns 1.

2.11. Functional Test

Voice Call

In GSM, Voice Call test can be performed for various Speech Channels with the Call Processing function.
Shown below is a list of Speech Channels supported by this measuring instrument.

Table 2.11-1 Speech Channel Suuport Chart

FS	13.0kbps
EFS	12.2kbps
HS	11.4kbps
AFS	12.2kbps
	10.2kbps
	7.95kbps
	7.40kbps
	6.70kbps
	5.90kbps
	5.15kbps
	4.75kbps
AHS	7.95kbps
	7.40kbps
	6.70kbps
	5.90kbps
	5.15kbps
	4.75kbps

The following describes an example of Origination test using voice codec at AFS 7.95kbps.

1. Execute **CALLPROC ON** and set Call Processing to On.
2. Execute **CODEC AFS** and set Codec to AFS.
3. Execute **NBRATE 7.95** and set Net Bit Rate to AFS 7.95kbps.
4. Make a call from a MS to the arbitrary telephone number.
   Call Processing state turns [Origination]. The originated telephone number can be confirmed on the MS Report screen.
5. Execute **CALLSTAT?** and wait until the status turns 7(=Communication).
   Call Processing state turns [Communication] and this measuring instrument and a MS can communicate with each other.
6. Execute **TESTPAT ECHO**, and set TCH Test Pattern to Echo and perform voice communication test by echo-back.
7. Execute **CALLSO** and disconnect from MT8820A or a MS by on hook proceess.
   Call Processing state turns MS Release/NW Release.

The connection sequence is shown in Fig.2.11-1 Connection Sequence.

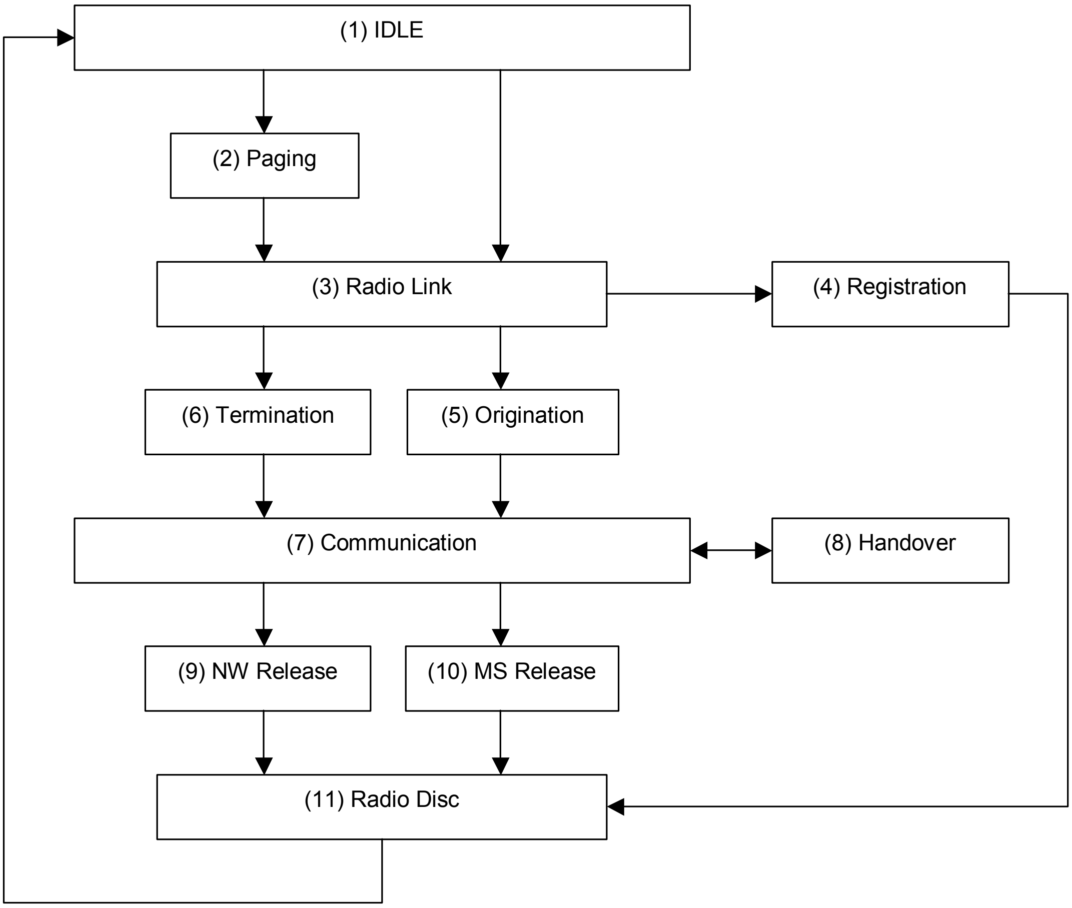


Fig. 2.11-1 Connection Sequence

Each status is confirmed with the comamnd **CALLRSLT?**.

As an example, the following describes the method to confirm if Registartion and Origination are completed properly.

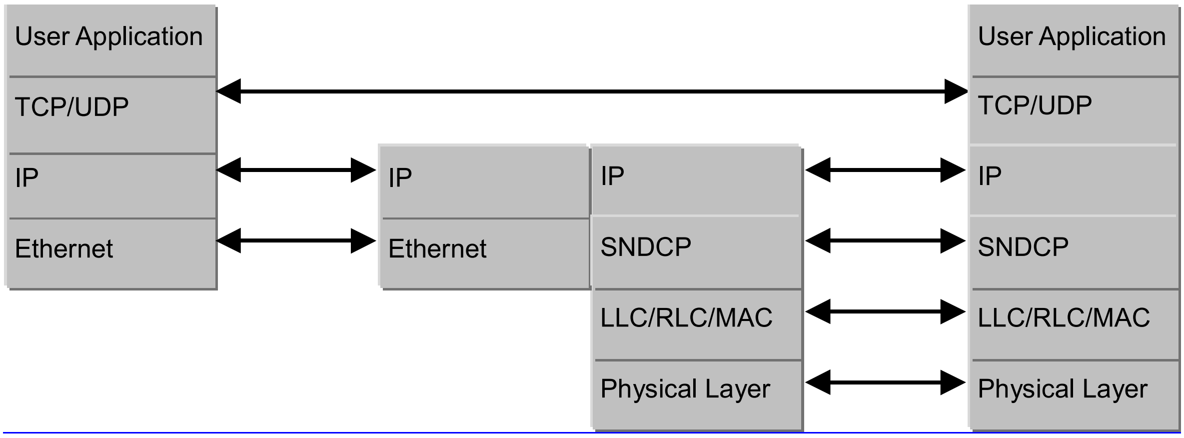
1. Execute CALLRSLT? 4 and confirm that Registartion status is 1,0(=Already executed, no errors).
2. Execute CALLRSLT? 5 and confirm that Origination status is 1,0(=Already executed, no errors).

Execute **CALLRFR** command when initializing each status in the connection sequence

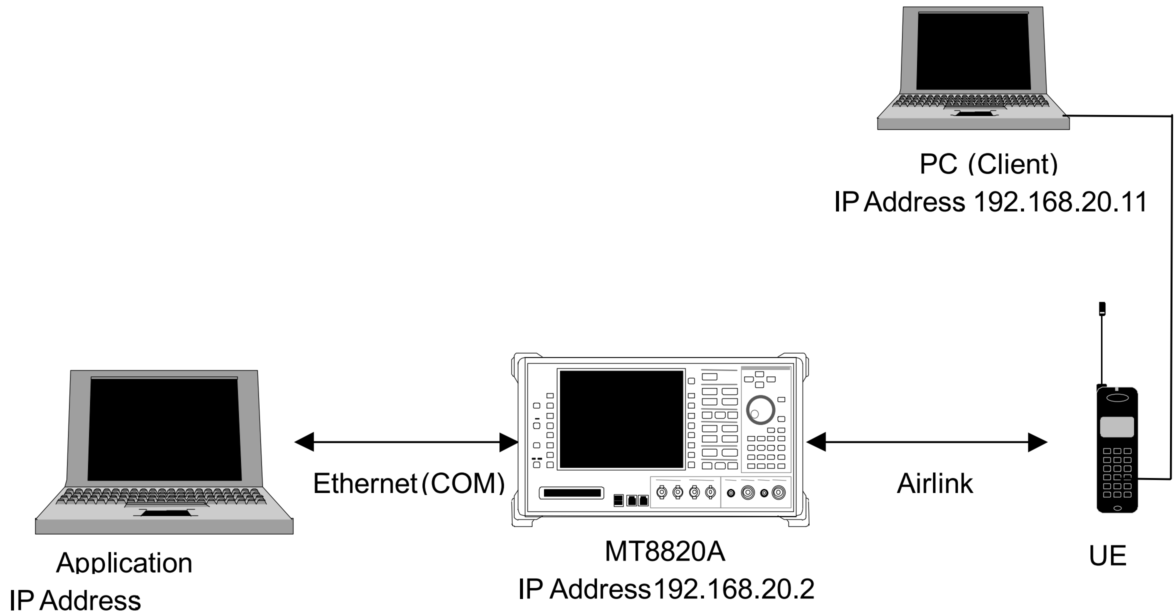
External Packet Data (Option MX882001A-02)

GPRS packet connection tests can be performed in GSM utilizing MX882001A-02 GSM External Packet Data option as well as the Call Processing function. IP connection is supported.

MT8820A enables to perform communications between a server PC and a client PC by supporting IP protocol communications on the wireless interface with an UE.



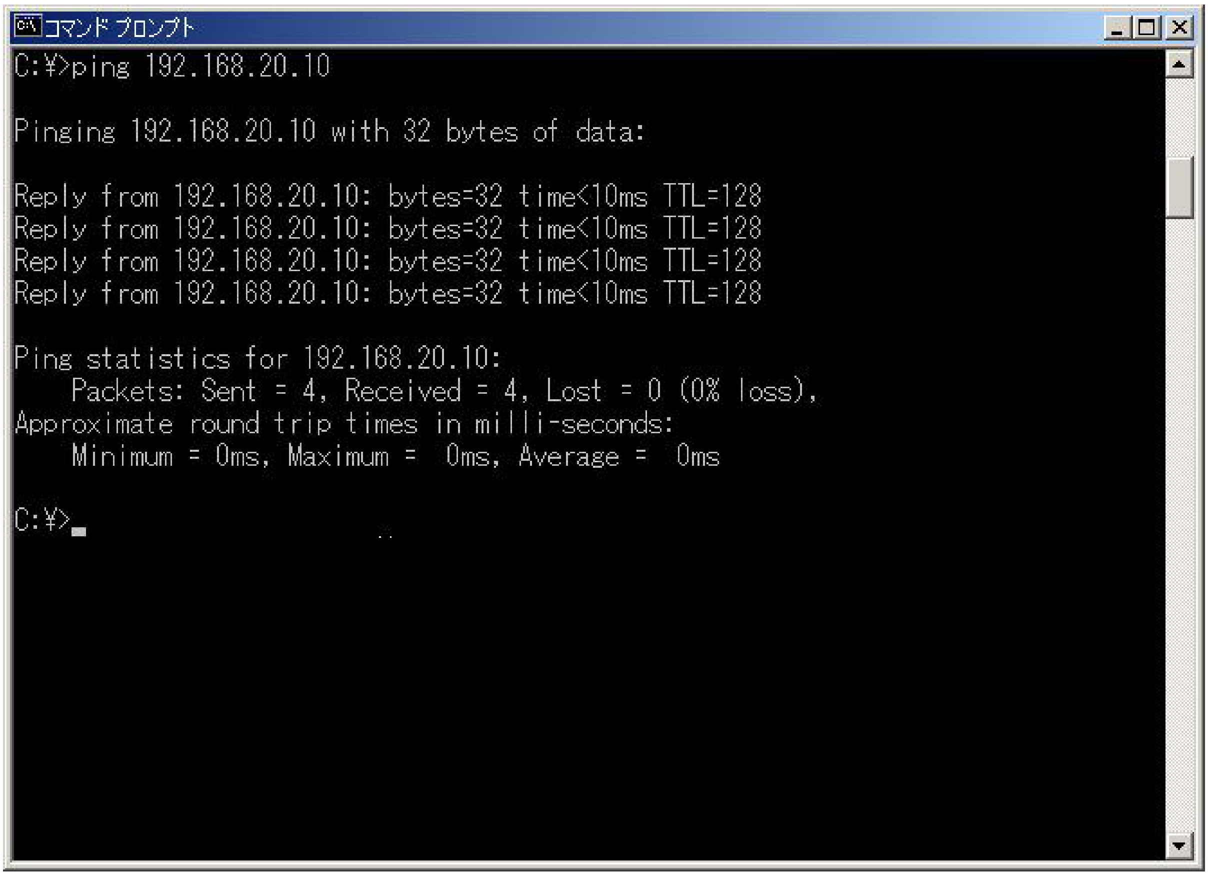
1. Connection without Gateway



<What is prepared>
UE that supports GPRS function
Server PC (Application Server)
Client PC (Client)
Cross cable for connecting a MT8820A and a Server PC

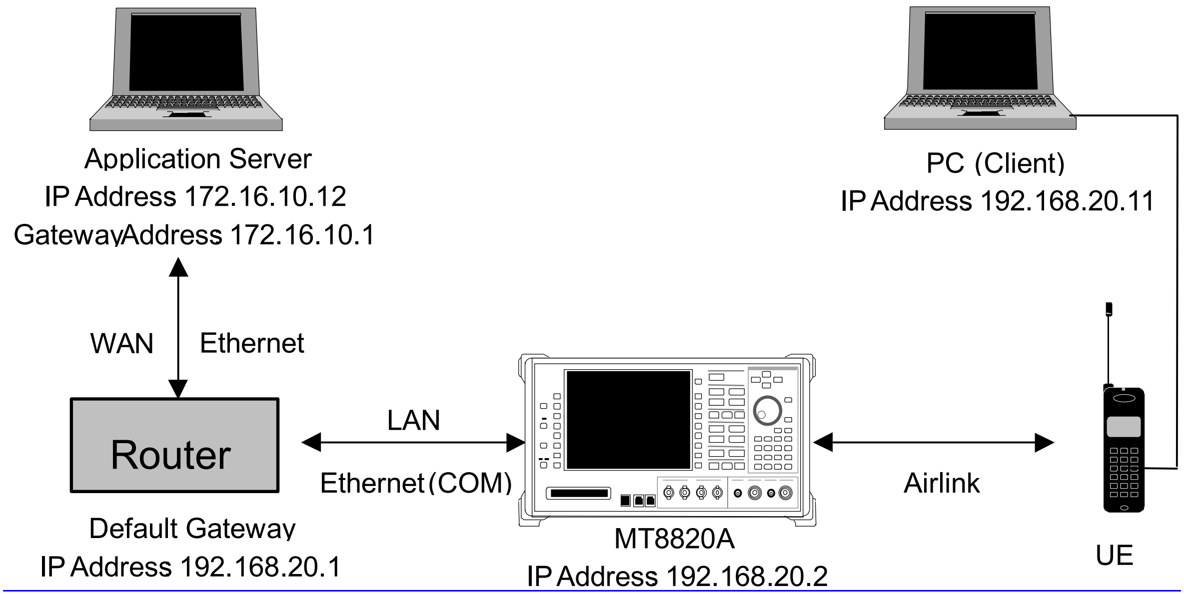
1. Set the IP address(the IP address of MT8820A unit) to the same segment address as those of UE and Server PC on the System Config screen.
2. Set the SubnetMask to correct address. (For ex. 255.255.255.0)
3. Set the Default Gateway address to the IP address set to the Server PC.
   (MT8820A sends the all IP packets from Client PC to the ServerPC. This reason is to avoid generating delay by searching time when MT8820A receives unknown address from Client.
4. Reload the GSM application on Standard Load screen.

5. Set [Call Processing] of Common Parameter to [On].
6. Set [Operating Mode] of Common Parameter to [GPRS].
7. Set [Connection Type] of Common Parameter to [Ext.Packet]
8. Confirm that the Client PC's DHCP setting is enabled.
9. Set [MS IP Address] of Call Processing Parameter. This IP address will be allocated to Client PC.
10. Turn On UE Power and perform Attach process.
    (Some UEs don’t move to attach process by only turning on Power. Please confirm the UE setting.)
11. Set the any values of Username and Password of Dial up screen on Client PC. MT8820A ignore these setting values and not necessary to set some fixed values for Username and Password.
12. Call Processing Status will be reached to [Activated] and the communication is ready between MT8820A and UE.
13. By executing ping command from either of Client PC or Server PC, the connection of data communication can be confirmed.
14. The data throuphput can be measured by installing FTP server to Server PC and download the some files from it.
15. Stop the dial-up connection on Client PC.
16. Call Processing Status will be moved from [Activated] to [Attached].



2. Connection with Gateway

The packet communications between different segments can be verified by connecting Gateway between a MT8820A and a Server PC.



<What is prepared>
UE that supports GPRS function
Server PC (Application Server)
Client PC (Client)
Gateway
Straight cable for connecting Gateway and a MT8820A or a Server PC.

1. Set the IP address(the IP address of MT8820A unit) to the same segment address as Gateway on the System Configuration screen.
2. Set the Default Gateway address and Subnet Mask on the System Config screen. The Default Gateway address must be the same as the IP address on the LAN side of a Router. (For instance, the Default Gateway address of a MT8820A must be set to 192.168.20.1 when the IP address on the LAN side of a Router is set to 192.168.20.1.)
3. Reload GSM applications on the Standard Load screen.
4. Set [Call Processing] of Common Parameter to [On].
5. Set [Operating Mode] of Common Parameter to [GPRS].
6. Set [Connection Type] of Common Parameter to [Ext. Packet]
7. Confirm that the Client PC's DHCP setting is enabled.
8. Set [MS IP Address] of Call Processing. This address will be allocated to Client PC.
9. Turn On UE Power and perform Attach process.
   (Some UEs don't move to attach process by only turning on Power. Please confirm the UE setting.)
10. Set the any values of Username and Password of Dial up screen on Client PC. MT8820A ignore these setting values and not necessary to set some fixed values for Username and Password.
11. Call Processing Status will be reached to [Activated] and the communication is ready between MT8820A and UE.
12. By executing ping command from either of Client PC or Server PC, the connection of data communication can be confirmed.
13. The data throuphput can be measured by installing FTP server to Server PC and download the some files from it.
14. Stop the dial-up connection on Client PC.
15. Call Processing Status will be moved from [Activated] to [Attached].

2.12. Calibration Measurement Function

Output power adjustment by Multi-burst RF Power measurement

Output power can be adjusted at high speed by batch measurement of sequentially varied DUT output power. The number of bursts that can be measured is 500 at max.
Multi-burst RF Power measurement is executed only by a remote command. Measurement result is not displayed on the screen of MT8820A. It can be acquired only by remote commands.

[Specification of the signal under test]
The signal under test must be GSM modulation signal (MS-Normal Burst) and GSM output timing. However, it does not have to be synchronized with the Downlink signal of MT8820A. Output power control of DUT is set to repeat with the fixed number of frames. Multi-burst RF Power measurement does not consider Idle frames.
Fig. 2.8.1-1 is pattern diagrams.

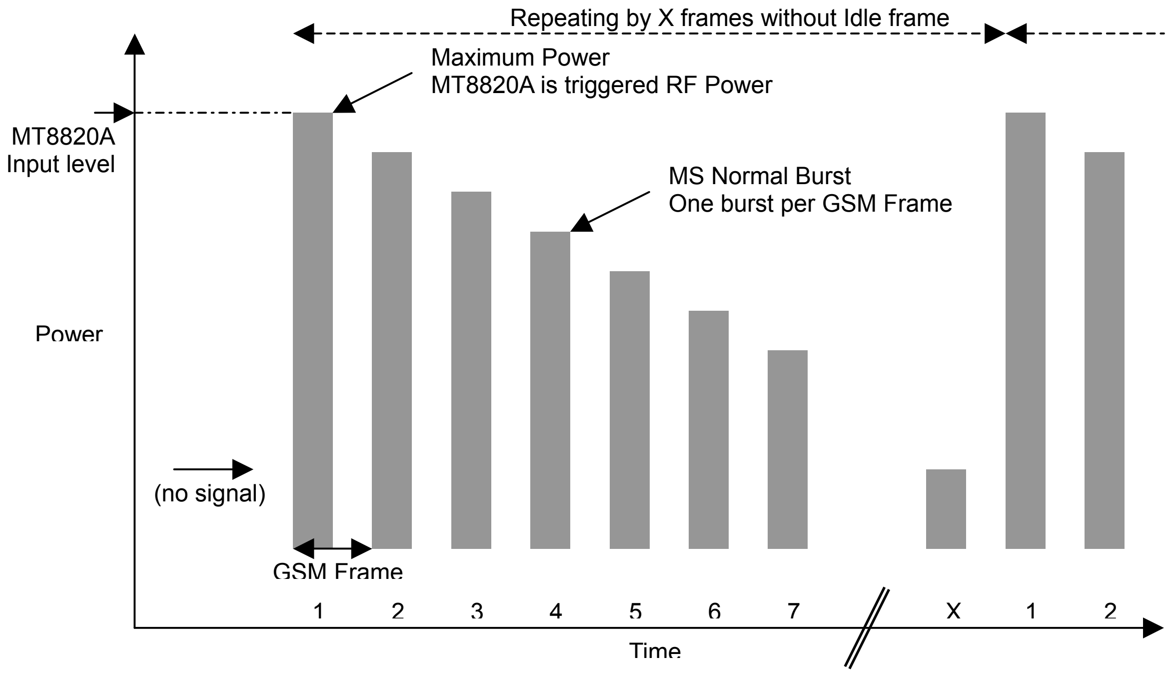


Fig.2.8.1-1 Specification of the signal under test in Multi-Burst RF Power measurement

The following is measurement procedures.
- Stop the output from DUT and set to standby state with required settings.
- Set the necessary parameters to MT8820A (e.g. OFF setting of Call Processing).
- Set the maximum output power of DUT to Input level of MT8820A so that intput signal is not saturated.
- Transmit the Multi-burst Power Measurement command to MT8820A and set it to measurement standby state.
- Start the output of DUT.
- Measurement starts when MT8820A detects signals. The threshold value of signal detection is Input Level-30dB(approx.) and measurement is triggered when the signal is inputted at higher level.
- Stop the output of DUT and read the measurement result from MT8820A after completing measurement.

[Specification of remote commands]

- Starting command for Multi-burst RF Power measurement

Command

SWPMRFPWR n

Parameter

n : The number of bursts to be measured

Parameter n can be omitted. If n is omitted, measurement is performed with the default number of bursts, 100.

- Query for reading measurement result (output power)

Query

MRFPWR?

Response

$p_1,p_2,p_3,\ldots p_n$

"p_x" returns the power of measured bursts in dBm unit. Valid number of digits is 0.01.
"*n*" shows the number of measured bursts, which is specified by SWPMRFPWR commands.

- Query for reading measurement result (burst status)

Query

MRFPWRSTAT?

Response

$s_1,s_2,s_3,\ldots s_n$

"s_x" indicates the status of each measured burst. The type of status will be described later.
"*n*" indicates the number of measured bursts. It is specified by SWPRFPWR commands.

- **Query for reading all measurement results**

Query

MRFPWRALL?

Response

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

"s_x" indicates the status of measured burst. The types of status are discribed later.
"p_x" returns measured power in dBm unit. Valid number of digits is 0.01.
"u_x" returns the maximum value in the burst ON segment in dB unit. Valid number of digits is 0.01.
"l_x" returns the minimum value in the burst ON segment in dB unit. Valid number of digits is 0.01.
"*n*" indicates the number of measured bursts. It is specified by SWPMRFPWR commands.

- Query for reading overall measurement status

Query

MSTAT?

Response

status

The usage of *MSTAT?* query and response *status* are almost the same as that of Fundamental measurment. Details are written on MX882001A GSM Measurement Software Operation Manual. Refer to the after-mentioned corresponding section for the error status of Multi-burst RF Power measurement.

- Timeout setting

Command

MRFPWR_TIMEOUT time

Query

MRFPWR_TIMEOUT?

Response

time

Parameter

time

“*time*” indicates timeout dulation. Setting range is 1~60 sec. Resolution is 1 sec.
Default value is 10 sec.

[Error status]

The relationship between error status per burst s_X and error status of overall measurement *status* is shown in the Table 2.8.1-1. Error status *status* depends on the burst status. If all the burst status s_X is Normal, error status *status* becomes Normal. If Signal Abnormal is detected in any of burst status s_X, error status *status* becomes Signal Abnormal.

Table 2.8.1-1 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

[Detection procedure of error status]

Fig. 2.8.1-2 shows the detection sequence of burst status sx and error status *status.*

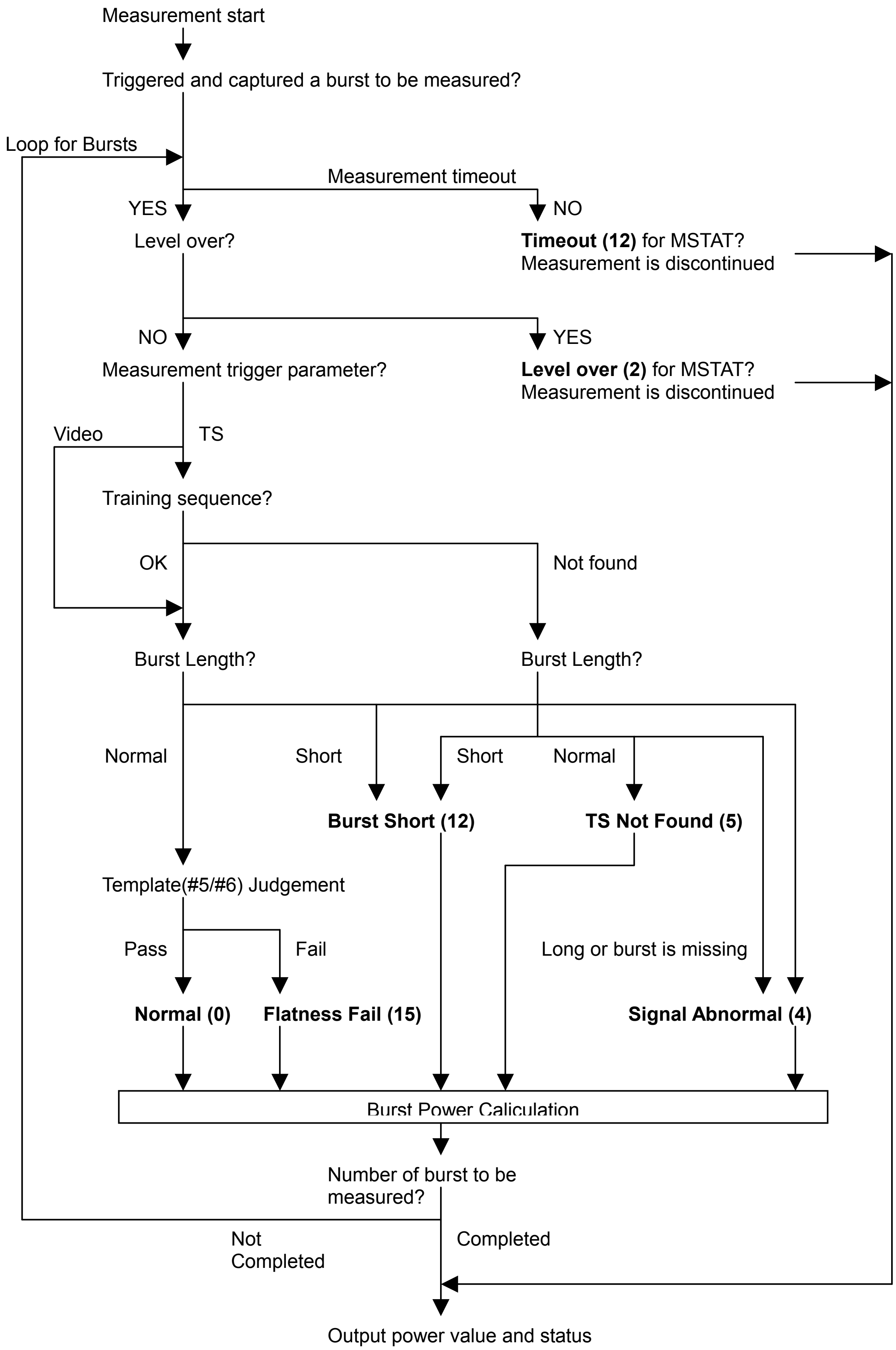


Fig. 2.8.1-2 Detection procedure of erorr status

[Example of remote control]

```
send( "CALLPROC OFF" );          /* Sets Call processing to OFF. */
-- DUT signal output start --
send( "SWPMRFPWR 128 " );        /* Starts Mult-burst RF Power measurement(128 bursts). */
send( "MSTAT?" );                /* Sends a query for measurement error status. */
read( buf );                     /* Reads the measurement error status. */
send( "MRFPWRSTAT?" );           /* Sends a query for burst status. */
read( buf );                     /* Reads the burst status. */
send( "MRFPWR?" );               /* Sends a query for each burst's power measurement result. */
read( buf );                     /* Reads each burst's power measurement result. */
```

Adjustment of an orthogonal modulator by TXIQ measurement

In the adjustment of a GSM MS's orthogonal modulator, carrier frequency and +/–67.708kHz(symbol rate/4) offset power are measured by outputting the rotating pattern from a MS. TXIQ measurement offers high-speed batch measurement of power at frequency points required for the adjustment of an orthogonal modluator. The measurement is performed at RBW=30kHz.
Although TXIQ measurement is performed as a part of modulation analysis in MT8820A, the measurement results are not displayed on the screen of MT8820A. It can be acquired only by a remote command.

[Measurement parameter]
TXIQ measurement is executed when the parameter shown in Table 2.8.2-1 is set.
TXIQ measurement is performed as a part of modulation analysis. Therefore, ON/OFF setting of measurement and the average count follow the parameter specified in the modulation analysis.

Table 2.8.2-1 Parameter setting of TXIQ measurement

No	Parameter	Setting
1	Call Processing	OFF
2	Measuring Object	Continuous
3	Modulation Analysis	ON
4	Average count of Modulation Analysis	Effective as the average count of TXIQ measurement

[Remote command]
TXIQ measurement is executed simultaneously by setting the parameter of Table 2.8.2-1 and executing Fundamental measurement. However, the measurement result must be read by a remote command because it is not displayed on the screen of MT8820A. Reading commands for TXIQ measurement result are shown in the table below.

Table 2.8.2-2 Query commands for TXIQ measurement result

No	Command	Function
1	AVG_TXIQ?	Send a query for the average value of TXIQ measurement result.
2	MAX_TXIQ?	Send a query for the maximum value of TXIQ measurement result.
3	MIN_TXIQ?	Send a query for the mimimum value of TXIQ measurement result.

Responses to the reading commands are as follows.

p1,p2,p3,p4,p5,p6,p7,p8,p9

p1~9 indicate the power of each frequency offset in dBm unit.
Offset frequencies are –270.833kHz(p1), –203.125kHz(p2), –135.417kHz(p3), –67.708kHz(p4), 0kHz (p5)(carrier frequency), +67.708kHz(p6), +135.417kHz(p7), +203.125kHz(p8), +270.833kHz(p9).

[Example of remote control]
The following is an example of remote control to execute TXIQ measurement at an average of ten times and read the max. value.

```
send( “CALLPROC OFF” );     /* Call Processing OFF. */
send( “MEASOBJ CONT” );     /* Sets Measuring Object to Continuous. */
send( “MOD_MEAS ON” );      /* Sets modulation analysis to ON. */
send( “MOD_COUNT 10” );     /* Sets the average count of modulation analysis to 10 times. */
-- MS signal output start --
send( “SWP” );              /* Starts the measurement. */
send( “MSTAT?” );           /* Reading command for measurement status. */
read( status );             /* Reads the measurement status. */
send( “MAX_TXIQ?” );        /* Reading command for TXIQ measurement result. */
read( result );             /* Reads the TXIQ measurement result. */
```

Phase Error measurement by Multiframe Phase Error measurement

Multiframe Phase Error measurement performs batch measurement of RMS Phase Error for 1 Multiframe except Idle Frame (However, burst signal is 25 bursts, allocating 1 slot to 1 Frame.) It is effective for high-speed measurement of RMS Phase Error under different parameters in MS inspection process.
Starting and result reading of Multiframe Phase Error measurement are performed by remote commands.
Measurement results are not displayed on the screen of MT8820A.

[Measurement parameter]
The measurement is executed when the parameter shown in Table 2.8.3-1 is set and Multiframe Phase Error measurement command is transmitted by remote control.

Table 2.8.3-1 Parameter setting of Multiframe Phase Error measurement

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

[Signal under test]
The signal under test must be GSM modulation signal and GSM output timing. Measurement is performed in segments with 25 frames, starting from the next frame of Idle Frame(Fig. 2.8.3-1).
In Multiframe Phase Error measurement, the average count of measurement can be specified by argument. When the average count is set to two or more, 1 Multiframe is regarded as one measurement segment and measurement results are averaged per corresponding slot.

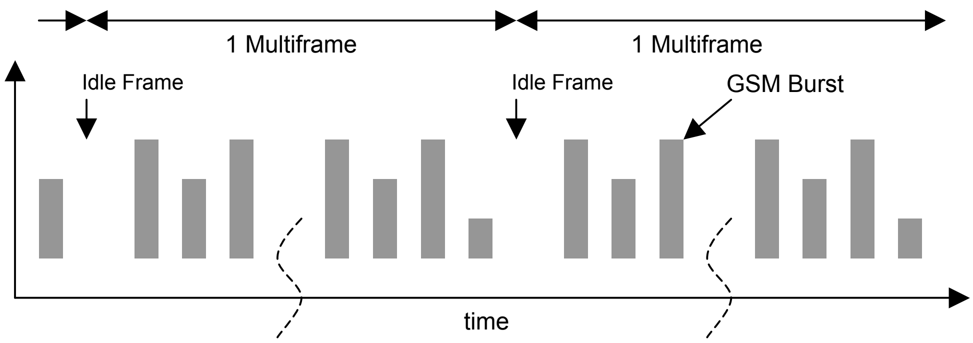


Fig. 2.8.3-1 Signal under test in Multiframe Phase Error measurement

[Remote command]
Measurement starting command
SWPMPHASEERR n

Parameter
n Average count, n=1 when it is omitted.

Query for measurement result
MPHASEERR? m

Parameter
m

[Example of remote control]

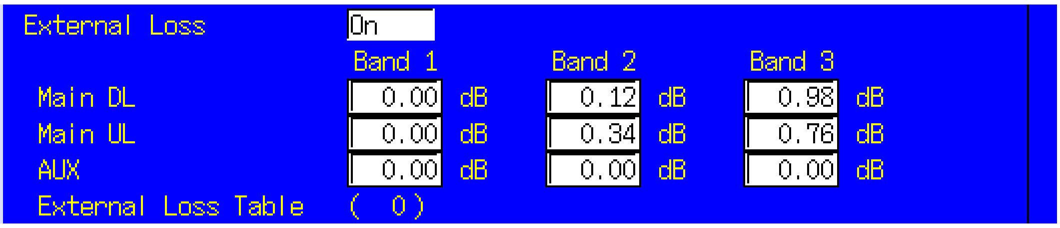
2.13. Others

External Loss

MT8820A can set External Loss such as cable loss as offset values.
There are two methods of External Loss value setting

- External Loss setting that is effective in GSM only
- Common External Loss setting that is effective in other standards as well as GSM. (Refer to 1.12.3 External Loss for detail.)

The following describes the External Loss setting that is effective in GSM only.
External Loss values can be set for Main DL, Main UL and Aux respectively in three bands.



The relationship between Band and frequency is shown in Table 2.14-1.

Table 2.13-1 Band and Freq. relationship of External Loss

	Band1	Band2	Band3
Frequency range	30.000000 MHz ~ 799.999999 MHz	800.000000 MHz ~ 1599.999999 MHz	1600.000000 MHz ~ 2700.000000 MHz
Corresponding GSM band	GSM450 GSM480 GSM750	P-GSM900 E-GSM900 R-GSM900 GSM850	DCS1800 PCS1900

The following describes an example to set the loss value of Main DL to 0.12 and Main UL to 0.34 for Band2, Main DL to 0.98 and Main UL to 0.76 for Band3.

1. Execute **DLEXTLOSS BAND2,0.12** and set Main DL loss value of Band2 to 0.12dB.
2. Execute **ULEXTLOSS BAND2,0.34** and set Main UL loss value of Band2 to 0.34dB.
3. Execute **DLEXTLOSS BAND3,0.98** and set Main DL loss value of Band2 to 0.98dB.
4. Execute **ULEXTLOSS BAND3,0.76** and set Main UL loss value of Band2 to 0.76dB.
5. Execute **EXTLOSSSW ON** and enable External Loss.

Power Control (SACCH Channel)

In case using SACCH channels to change PCL (Power Control Level), the level of transmitting signal of UE will be changed at 2 [dB] by every 60msec (13TDMA Frame).

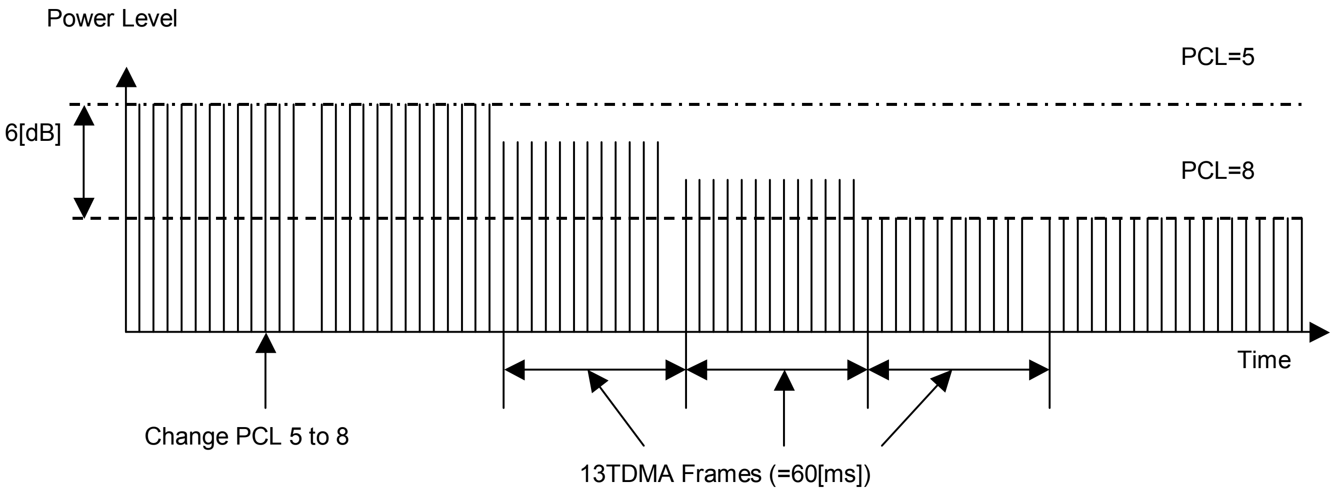


Fig. 2.13-1 Power Control by using SACCH Channel (In case of changing from PCL 5 to 8)

How to measure the signal level of each PCL in accordance with the above theory is described as follows.

<Instruction>

1. Connect to UE (reffer to 2.3.1 (the connection by GSM)
2. To set Power measurement, send GPIB command (**ALLMEASITEMS ON,OFF,1,OFF,OFF,OFF,OFF,OFF,OFF,1,OFF,OFF,1,OFF,OFF,1,OFF,OFF**) to the MT8820A, and set averaging count to '1'.
3. To set measurement mode to the high-speed measurement (no graphical display, numeric data only), send GPIB command (**MEASMODE FAST**) to the MT8820A.
4. To set PCL to '5', send GPIB command (**MSPWR 5**) to the MT8820A.
5. To hold Input level setting value of PCL 5, send GPIB commmand (**ILVLCTRL MANUAL**) to the MT8820A.
6. To set SACCH to channel that informs PCL to the UE, send GPIB command (**MSPWRCTRL SACCH**) to the MT8820A.
   (It is available ony GPIB command. It can not change on screen.)
7. To change PCL to '15', send GPIB command (**MSPWR 15**) to the MT8820A.
8. To repeat measurement and to capture measurement result until PLC changing has been finished. Send GPIB command (**SWP;TXPWR?**) to the MT8820A repeatedly.
   (If PCL is changed from '5' to '15', it should be taken 1.6 sec at least, because the time to change power will be taken 600 msec and also there is delay time between UE and PC (Max 960 msec). Therefore, please do measurement repeatedly.)
9. To set FACCH again to channel that informs PCL to the UE, send GPIB command (**MSPWRCTRL FACCH**) to the MT8820A.

Detect the power level on each PCL from table of measurement result value that was captured by instruction 8.

[e.g]

MSPWR 15 0		Change PCL from 5 to 15
SWP;TXPWR?	33.12	Repeat measurement (SWP) and get a result vaue as follows.
SWP;TXPWR?	33.12	PCL=5
SWP;TXPWR?	33.12	PCL=5
SWP;TXPWR?	33.12	PCL=5
SWP;TXPWR?	33.13	PCL=5
SWP;TXPWR?	33.13	PCL=5
SWP;TXPWR?	33.12	PCL=5
SWP;TXPWR?	33.12	PCL=5
SWP;TXPWR?	33.12	PCL=5
SWP;TXPWR?	33.12	PCL=5
SWP;TXPWR?	33.12	PCL=5

SWP;TXPWR?	30.73	PCL=6
SWP;TXPWR?	29.20	PCL=7
SWP;TXPWR?	27.05	PCL=8
SWP;TXPWR?	24.90	PCL=9
SWP;TXPWR?	22.90	PCL=10
SWP;TXPWR?	20.81	PCL=11
SWP;TXPWR?	18.68	PCL=12
SWP;TXPWR?	16.75	PCL=13
SWP;TXPWR?	14.71	PCL=14
SWP;TXPWR?	12.81	PCL=15
SWP;TXPWR?	12.80	PCL=15
SWP;TXPWR?	12.80	PCL=15
SWP;TXPWR?	12.80	PCL=15
SWP;TXPWR?	12.79	PCL=15
SWP;TXPWR?	12.80	PCL=15

The actual speed of ‘SWP;TXPWR?’ is changeable by performance of PC.(depending on PC spec). therefore, some problem might occur. (E.g : timing of PCL changing is a bit too late, measurement result value will be captured more than twice during the changing PCL.)
If you got problem, please do either adjust the actual speed or manage to estimate from measurement result.

MS-TXPWR-MAX-CCH

The setting value of MS-TXPWR-MAX-CCH should be set so that UE output power is maximum, if it is not specified in the 3GPP TS51.010.

MS-TXPWR-MAX-CCH is used as the cell selection parameter judging if an UE has to keep the connection when the received power level from a Base station becomes low. Therefore when the setting value is high, the UE might become easier to be disconnected at BER measurement under low power level.

Table 2.13-3 Maximum output power and Power Class relationship on GMSK modulation

Power class	GSM 400 & GSM 900 & GSM 850 & GSM 700 Nominal Maximum output power	DCS 1 800 Nominal Maximum output power	PCS 1 900 Nominal Maximum output power
1	- - - - - -	1 W (30 dBm)	1 W (30 dBm)
2	8 W (39 dBm)	0,25 W (24 dBm)	0,25 W (24 dBm)
3	5 W (37 dBm)	4 W (36 dBm)	2 W (33 dBm)
4	2 W (33 dBm)		
5	0,8 W (29 dBm)		

Table 2.13-4 Maximum output power and Power Class relationship on 8PSK modulation

Power class	GSM 400 and GSM 900 & GSM 850 & GSM 700 Nominal Maximum output power	DCS 1 800 Nominal Maximum output power	PCS 1 900 Nominal Maximum output power
E1	33 dBm	30 dBm	30 dBm
E2	27 dBm	26 dBm	26 dBm
E3	23 dBm	22 dBm	22 dBm

To test with GSM phone of power class 4 (maximum power= +33dBm), MS_TXPWR_MAX_CCH should be set to '5'. The setting values of MS_TXPWR_MAX_CCH are used the Power Control Level same as MS Power Level. (Please refer Table2.13-5).

How to set MS_TXPWR_MAX_CCH to 5 is described below.

1. Execute **MSPWR_CCH 5** and set MS_TXPWR_MAX_CCH to 5.

Table 2.13-5 PCL setting and Output Power relationship

GSM400, GSM900, GSM850 and GSM700

Power control level	Nominal Output power (dBm)
0-2	39
3	37
4	35
5	33
6	31
7	29
8	27
9	25
10	23
11	21
12	19
13	17
14	15
15	13
16	11
17	9
18	7
19-31	5

DCS 1800

Power control level	Nominal Output power (dBm)
29	36
30	34
31	32
0	30
1	28
2	26
3	24
4	22
5	20
6	18
7	16
8	14
9	12
10	10
11	8
12	6
13	4
14	2
15-28	0

PCS1900	
Power Control Level	Output Power (dBm)
22-29	Reserved
30	33
31	32
0	30
1	28
2	26
3	24
4	22
5	20
6	18
7	16
8	14
9	12
10	10
11	8
12	6
13	4
14	2
15	0
16-21	Reserved

3. Audio Measurement

3.1. Specification

Table 1.1-2 W-CDMA/GSM Voice Codec Option Specification

Item	Specification
Voice codec	W-CDMA : AMR 12.2 kbps GSM : EFR, AMR
Codec level adjustment	Encoder input gain: –3.00~3.00 dB, 0.01 dB step Handset microphone volume: 0, 1, 2, 3, 4, 5 Handset speaker volume: 0, 1, 2, 3, 4, 5
AF output	Frequency range: 30 Hz~10 kHz, 1 Hz resolution Setting range: 0~5 Vpeak(AF Output connector) Setting resolution: 1 mV(≤5 Vpeak), 100µV(≤500 mVpeak), 10µV(≤50 mVpeak) Accuracy: ±0.2 dB(≥10 mVpeak, ≥50 Hz), ±0.3 dB(≥10 mVpeak, <50 Hz) Waveform distortion: ≤30 kHz band ≤–60 dB(≥500 mVpeak, ≤5 kHz), ≤–54 dB(≥70 mVpeak) Output impedance: ≤1Ω Maximum output current: 100 mA
AF input	Frequency range: 50 Hz~10 kHz Input voltage range: 1 mVpeak~5 Vpeak(AF Input connector) Maximum allowable input voltage: 30 Vrms Input impedance: 100 kΩ
Frequency measurement	Accuracy: Reference oscillator accuracy +0.5 Hz
Level measurement	Accuracy: ±0.2 dB(≥10 mVpeak, ≥50 Hz) ±0.4 dB(≥1 mVpeak, ≥1 kHz)
SINAD measurement	Frequency: 1 kHz in ≤30 kHz band ≥60 dB(≥1000 mVpeak), ≥54 dB(>50 mVpeak), ≥46 dB(≥10 mVpeak)
Distortion measurement	Frequency: 1 kHz in ≤30 kHz band ≤–60 dB(≥1000 mVpeak), ≤–54 dB(>50 mVpeak), ≤–46 dB(≥10 mVpeak)

3.2. How to use Voice Codec in W-CDMA

In W-CDMA, Voice Codec can be used in the connection at AMR12.2kbps.
MX882000B-01 option is required.

1. Execute **CALLPROC ON** and set Call Processing to ON.
2. Execute **TESTMODE OFF** and set Test Loop Mode to OFF.
3. Execute **CHCODING VOICE** and set Channel Coding to Voice.
4. Execute **DTCHPAT VOICE** and set DTCH Data Pattern to Voice CODEC.
5. Perform call processing to enable the Voice Codec function.

3.3. How to use Voice Codec in GSM

In GSM, Voice Codec can be used in the connection of EFS,AFS and AHS.
MX882001A-01 option is required.

1. Execute **CODEC EFS** and set Codec to EFS.
2. Execute **TESTPAT VOICE** and set TCH Test Pattern to Voice CODEC.
3. Perform call processing to enable the Voice Codec function.

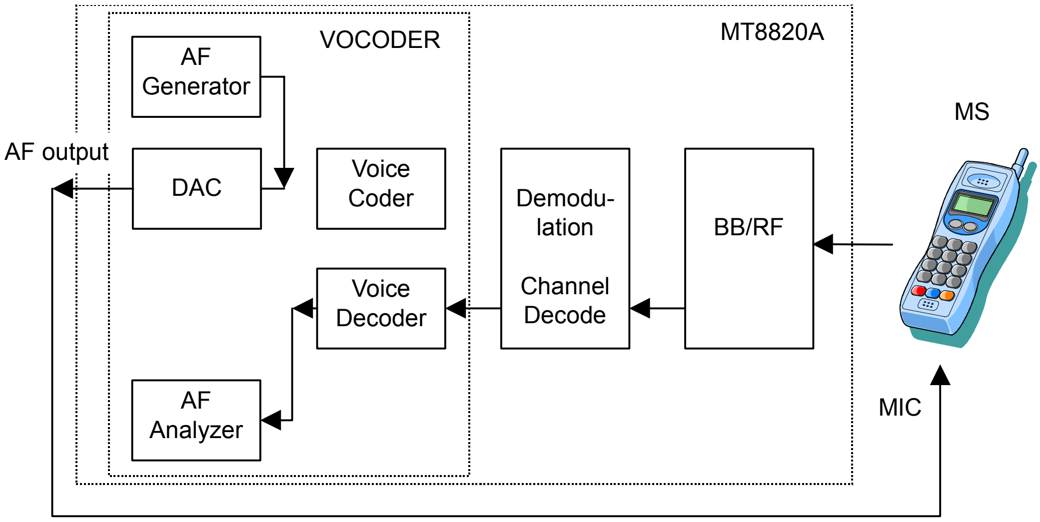
3.4. Communication Test

Communication test can be performed by connecting a handset to a MT8820A.

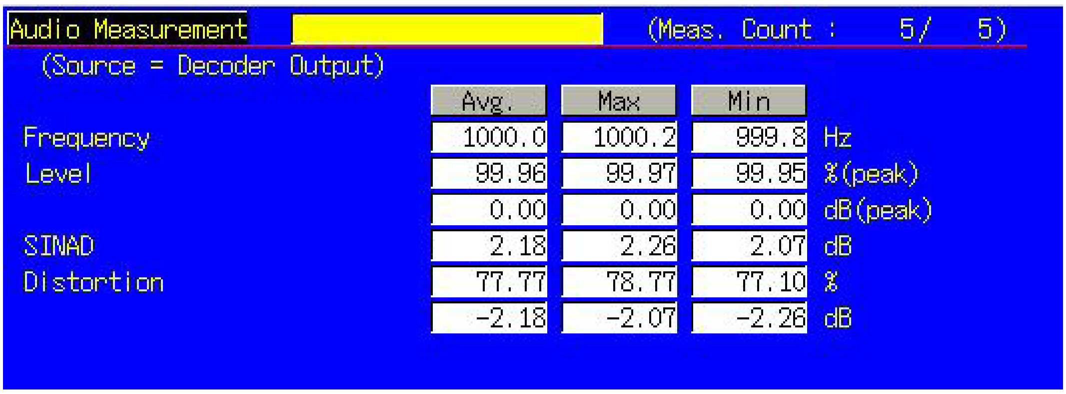
1. Enable the Voice Codec function and perform call processing.
2. Execute **AF_MODE VOICE** and set AF Mode to Voice Codec.
3. Execute **AINOUT HANDSET** and set AF Input/Output to Handset.

3.5. TX Audio Measurement

When the tone signal that is transmitted from an AF Output of MT8820A is inputted in a MS's MIC, the MS encodes the voice signal and transmits it as the uplink signal. MT8820A receives the uplink signal and inputs the decoded voice signal in an AF Analyzer. Thus, frequency, level and distortion rate can be measured.



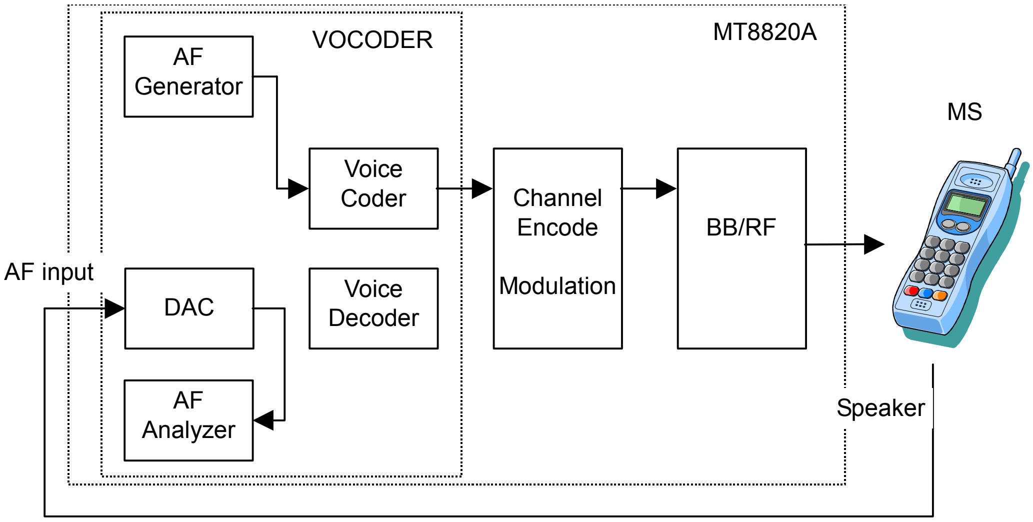
1. Enable the Voice Codec function and perform call processing.
2. Execute **AF_MODE TXAUDIO** and set AF Mode to TX Audio.
3. Execute **AF_FREQ 1000** and set AF Frequency to 1kHz.
4. Execute **AF_TGLVL 100** and set AF Level to 100mV.
5. Execute **AF_MEAS ON** and set Audio measurement to On.
6. Execute **AF_AVG 5** and set the average count of Audio measurement to 5 times.
7. Execute **SWP** and perform Audio measurement of Decoder Output signal.
8. Execute **AVG_AFFREQ?** and read the result of Frequency measurement.
9. Execute **AVG_TAFLVL?** and read the result of Level measurement.
10. Execute **AVG_AFDSTN_DB?** and read the result of distortion rate measurement.


Audio Measurement (Meas. Count : 5/ 5)
(Source = Decoder Output)

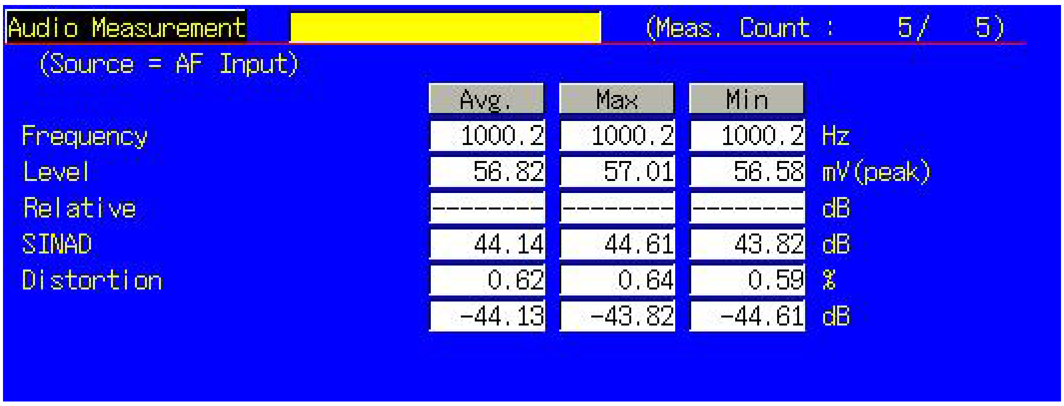
	Avg.	Max	Min	
Frequency	1000.0	1000.2	999.8	Hz
Level	99.96	99.97	99.95	%(peak)
	0.00	0.00	0.00	dB(peak)
SINAD	2.18	2.26	2.07	dB
Distortion	77.77	78.77	77.10	%
	-2.18	-2.07	-2.26	dB

3.6. RX Audio Measurement

MT8820A encodes the tone signal that is generated in an AF Generator and transmits it as the downlink signal. The MS decodes the received downlink signal and outputs the voice signal from a speaker. The voice signal is inputted in the AF Iutput of MT8820A and AF Analyzer measures frequency, level and distortion rate.



1. Enable the Voice Codec function and perform call processing.
2. Execute **AF_MODE RXAUDIO** and set AF Mode to RX Audio.
3. Execute **AF_FREQ 1000** and set AF Frequency to 1kHz.
4. Execute **AF_EILVL -6** and set Encode Input Level to –6dB.
5. Execute **AF_IRANGE 500** and set Input Level Range to 500mV.
6. Execute **AF_MEAS ON** and set Audio measurement to On.
7. Execute **AF_AVG 5** and set the average count of Audio measurement to 5 times.
8. Execute **SWP** and perform Audio measurement of the signal inputted in AF Input.
9. Execute **AVG_AFFREQ?** and read the resulf of Frequency measurement.
10. Execute **AVG_RAFLVL?** and read the result of Level measurement.
11. Execute **AVG_AFDSTN_DB?** and read the result of distortion rate measurement.



3.7. General-purpose Audio Generator/Analyzer

MT8820A can be used as a general-purpose Audio Generator/Analyzer.

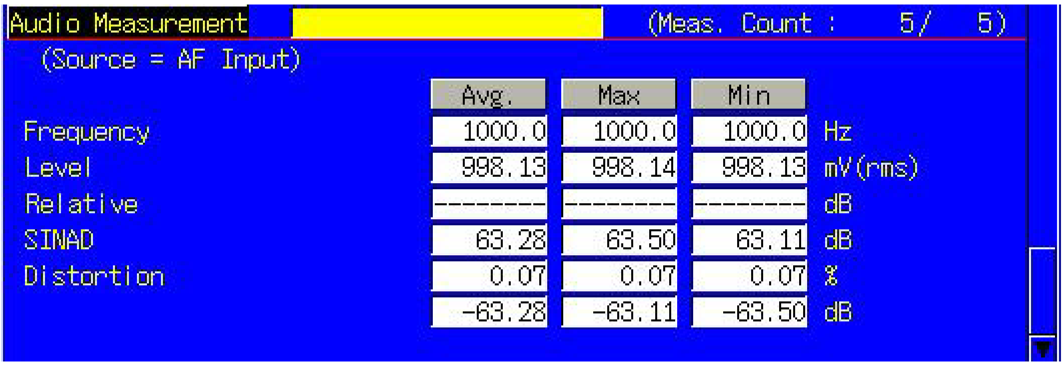
1. Execute **AF_MODE GENERAL** and set AF Mode to General.

Audio Genrator function

2. Execute **AF_FREQ 1000** and set AF Frequency to 1kHz.
3. Execute **AF_TGLVL 1000** and set AF Level to 1000mV.
4. 1kHz and 1000mV tone signals are outputted from AF Output.

Audio Analyzer function

5. Execute **AF_MEAS ON** and set Audio measurement to On.
6. Execute **AF_AVG 5** and set the average count of Audio measurement to 5 times.
7. Execute **SWP** and perform Audio measurement of the signal inputted in AF Input.
8. Execute **AVG_AFFREQ?** and read the result of Frequency measurement.
9. Execute **AVG_RAFLVL?** and read the result of Level measurement.
10. Execute **AVG_AFDSTN_DB?** and read the resulf of distortion rate meausurement.

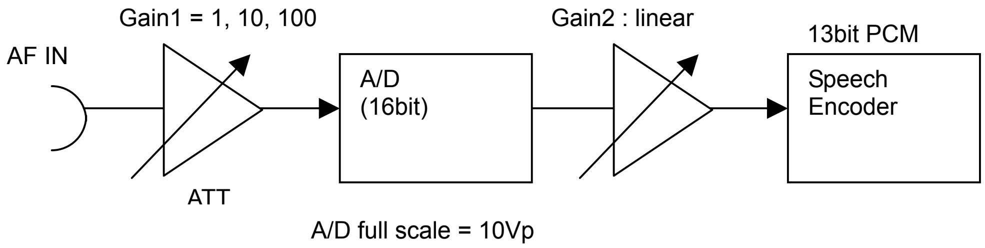


3.8. Full Scale of AF Input/Output in the use of Voice Codec

The following describes the Full Scale when AF Mode is set to Voice Codec and AF Input/Output is set to AF

AF Input

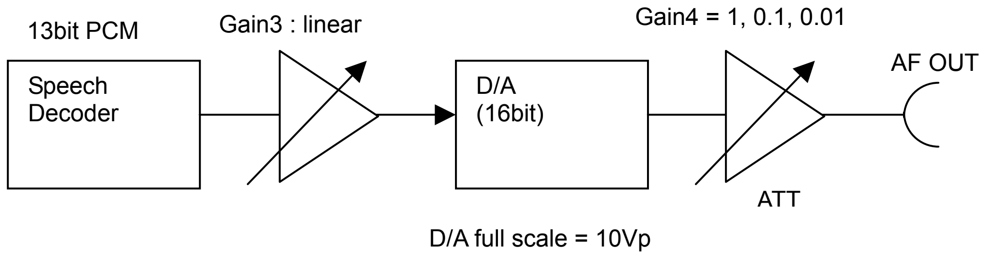
There exist Full Scale and Gain Adjust as parameters relevant to AF Input.
Full Scale is AF input level that corresponds to the full scale of Speech Encoder. In MT8820A, ATT selects three ranges; 5V~500mV, 500mV~50mV and 50mV~1mV. For lower resolutions, gain adjustment is performed digitally.
Also, the offset of full scale can be inputted in Gain Adjust.



AF Input Parameter		Internal Gain	
Full Scale (1mV~5Vpeak)	Gain Adjust [dB] (–3.0~+3.0dB)	Gain1	Gain2
5Vpeak	0.0	1	10/5/8 = 0.25
500mVpeak	0.0	10	10/(0.5*10)/8 = 0.25
51mVpeak	0.0	10	10/(0.051*10)/8 = 2.45
50mVpeak	0.0	100	10/(0.05*100)/8 = 0.25
x (0.5V~5Vpeak)	y	1	10/x/8*10^(y/20)
x (50mV~0.5Vpeak)	y	10	10/(x*10)/8*10^(y/20)
x (~50mVpeak)	y	100	10/(x*100)/8*10^(y/20)

AF Output

There exists Full Scale as a parameter relevant to AF Output.
Full Scale is AF output level that corresponds to the full scale of Speech Decoder. In MT8820A, ATT selects three ranges; 5V~500mV, 500mV~50mV and 50mV~. For lower resolutions, gain adjustment is performed digitally.

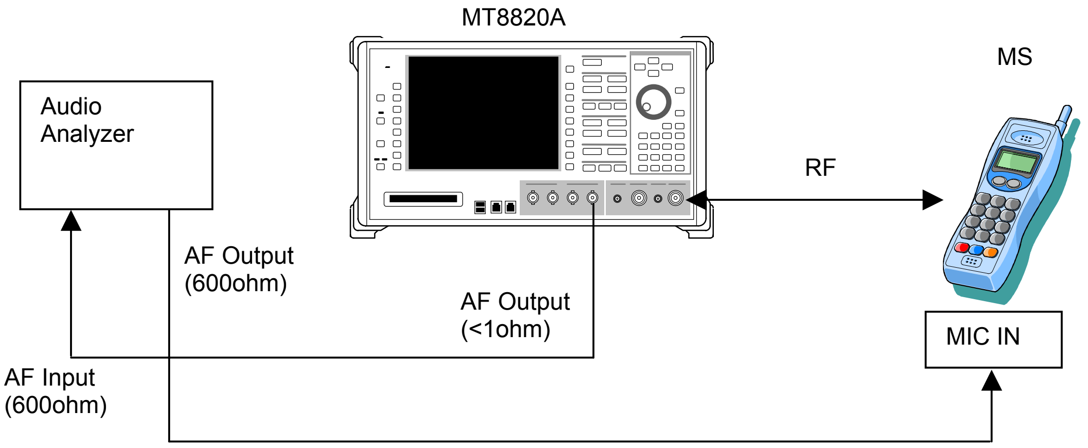


AF Output Parameter	Internal Gain	
Full Scale (~5Vpeak)	Gain3	Gain4
5Vpeak	5/10*8 = 4	1
500mVpeak	0.5/(10*0.1)*8 =4	0.1
51mVpeak	0.051/(10*0.1)*8 =0.4	0.1
50mVpeak	0.05/(10*0.01)*8 = 4	0.01
x (0.5V~5Vpeak)	x/10*8	1
x (50mV~0.5Vpeak)	x/(10*0.1)*8	0.1
x (~50mVpeak)	x/(10*0.01)*8	0.01

3.9. Sound Measurement

This section indicates how to use MT8820A in the case of performing sound measurement established in 3GPP TS 26.131, 26.132.
When this measurement is performed, an external Audio Generator/ Analyzer are required.

Transmitter Test



1. Perform call processing with Voice Codec available setting.
2. Execute **AF_MODE VOICE** and set AF Mode Voice Codec.
3. Execute **AINOUT AF** and set Audio Input/Output AF.
4. Execute **AOFLSCL 1110** and set AF Output Full Scale 1110mV.
5. Transmit voice signal from Audio Generator and perform sound measurement by Audio Analyzer.

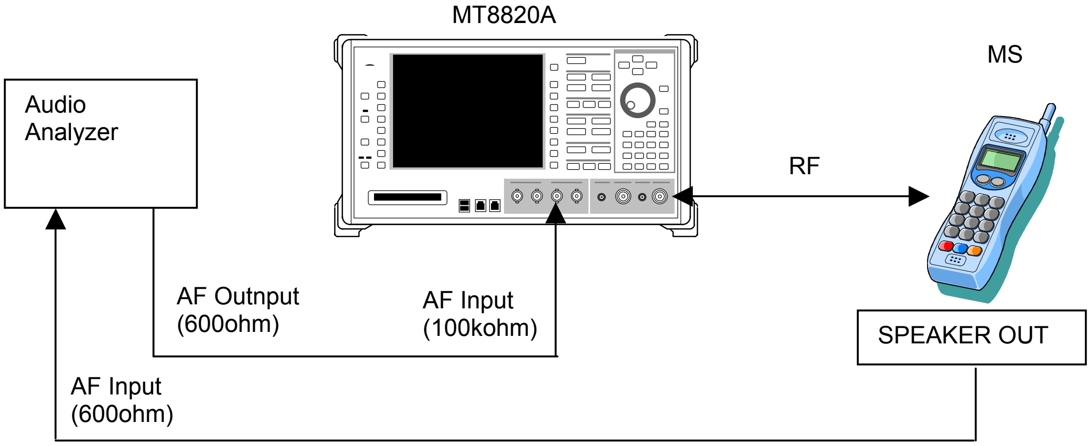
Then, AF Output Full Scale calculates like <Calculation> below based on following <Condition>. This is a condition of D/A converter described in 3GPP TS 26.132 5.2.1 Codec approach and specification.
<Condition>

D/A converter - a Digital Test Sequence (DTS) representing the codec equivalent of an analogue sinusoidal signal whose rms value is 3,14 dB below the maximum full load capacity of the codec shall generate 0 dBm across a 600 ohm load;

<Calculation>

Regarding 0dBm, if impedance is 600ohm, voltage will be 774.6mV.
If 0dBm sinusoidal signal with 3.14dB below outputs from full load capacity of the codec, it can meet the condition.
Therefore, AF Output Full Scale becomes 774.6*10^(3.14/20) = 1110mV.

Receiver Test



1. Perform call processing with Voice Codec available setting.
2. Execute **AF_MODE VOICE** and set AF Mode Voice Codec.
3. Execute **AINOUT AF** and set Audio Input/Output AF.
4. Execute **AIFLSCL 2210** and set AF Input Full Scale 2210mV.
5. Transmit voice signal from Audio Generator and perform sound measurement by Audio Analyzer.

Then, AF Input Full Scale calculates like <Calculation> below based on following <Condition>. This is a condition of A/D converter described in 3GPP TS 26.132 5.2.1 Codec approach and specification.
<Condition>

A/D converter - a 0 dBm signal generated from a 600 ohm source shall give the digital test sequence (DTS) representing the codec equivalent of an analogue sinusoidal signal whose RMS value is 3,14 dB below the maximum full-load capacity of the codec.

<Calculation>

Regarding 0dBm, if impedance is 600ohm, voltage will be 774.6mV. However, input impedance of MT8820A is 100kohm, so input voltage will be 774.6*2 = 1549mV.
To meet the condition, 0dBm sinusoidal signal shall be 3.14dB below from full load capacity of the codec.
Therefore, AF Input Full Scale becomes 1549*10^(3.14/20) = 2220mV.

Specifications are subject to change without notice.

ANRITSU CORPORATION
5-1-1 Onna, Atsugi-shi, Kanagawa, 243-8555 Japan
Phone: +81-46-223-1111
Fax: +81-46-296-1264

● U.S.A.
ANRITSU COMPANY
TX OFFICE SALES AND SERVICE
1155 East Collins Blvd., Richardson, TX 75081, U.S.A.
Toll Free: 1-800-ANRITSU (267-4878)
Phone: +1-972-644-1777
Fax: +1-972-644-3416

● Canada
ANRITSU ELECTRONICS LTD.
700 Silver Seven Road, Suite 120, Kanata,
ON K2V 1C3, Canada
Phone: +1-613-591-2003
Fax: +1-613-591-1006

● Brasil
ANRITSU ELETRÔNICA LTDA.
Praca Amadeu Amaral, 27 - 1 andar
01327-010 - Paraiso, Sao Paulo, Brazil
Phone: +55-11-3283-2511
Fax: +55-11-3886940

● U.K.
ANRITSU LTD.
200 Capability Green, Luton, Bedfordshire LU1 3LU, U.K.
Phone: +44-1582-433280
Fax: +44-1582-731303

● Germany
ANRITSU GmbH
Nemetschek Haus Konrad-Zuse-Platz 1 81829
München, Germany
Phone: +49 (0) 89 442308-0
Fax: +49 (0) 89 442308-55

● France
ANRITSU S.A.
9, Avenue du Québec Z.A. de Courtabœuf 91951 Les Ulis Cedex, France
Phone: +33-1-60-92-15-50
Fax: +33-1-64-46-10-65

● Italy
ANRITSU S.p.A.
Via Elio Vittorini, 129, 00144 Roma EUR, Italy
Phone: +39-06-509-9711
Fax: +39-06-502-2425

● Sweden
ANRITSU AB
Borgafjordsgatan 13 164 40 Kista, Sweden
Phone: +46-853470700
Fax: +46-853470730

● Finland
ANRITSU AB
Teknobulevardi 3-5, FI-01530 Vantaa, Finland
Phone: +358-9-4355-220
Fax: +358-9-4355-2250

● Denmark
Anritsu AB Danmark
Korskildelund 6 DK - 2670 Greve, Denmark
Phone: +45-36915035
Fax: +45-43909371

● Singapore
ANRITSU PTE LTD.
10, Hoe Chiang Road #07-01/02, Keppel Towers,
Singapore 089315
Phone: +65-6282-2400
Fax: +65-6282-2533

● Hong Kong
ANRITSU COMPANY LTD.
Suite 923, 9/F., Chinachem Golden Plaza, 77 Mody Road, Tsimshatsui East, Kowloon, Hong Kong, China
Phone: +852-2301-4980
Fax: +852-2301-3545

● P. R. China
ANRITSU COMPANY LTD.
Beijing Representative Office
Room 1515, Beijing Fortune Building, No. 5 North Road, the East 3rd Ring Road, Chao-Yang District
Beijing 100004, P.R. China
Phone: +86-10-6590-9230

● Korea
ANRITSU CORPORATION
8F Hyun Juk Bldg. 832-41, Yeoksam-dong,
Kangnam-ku, Seoul, 135-080, Korea
Phone: +82-2-553-6603
Fax: +82-2-553-6604

● Australia
ANRITSU PTY LTD.
Unit 3/170 Forster Road Mt. Waverley, Victoria, 3149, Australia
Phone: +61-3-9558-8177
Fax: +61-3-9558-8255

● Taiwan
ANRITSU COMPANY INC.
7F, No. 316, Sec. 1, NeiHu Rd., Taipei, Taiwan
Phone: +886-2-8751-1816
Fax: +886-2-8751-1817

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