RF TEST REPORT

Test item	:	GPS Device
Model No.	:	GPS100MVPA
Order No.	:	1101-00119
Date of receipt	:	2011-01-27
Test duration	:	2011-03-05 ~ 2011-03-16
Date of issue	:	2011-03-21
Use of report	:	FCC Original Grant

Applicant : JOA TELECOM CO., LTD.
1007, SICOX Tower, 513-14, Sangdaewon-dong, Jungwon-gu, Seongnam-si, Gyeonggi-do, 462-806, Korea

Test laboratory : Digital EMC Co., Ltd.
683-3, Yubang-Dong, Cheoin-Gu, Yongin-Si, Kyunggi-Do, 449-080, Korea

Test specification	:	§22(H)
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:	Witnessed by:	Reviewed by:
Engineer S.K.RYU	N/A	Manager W.J. Lee

CONTENTS

1. Equipment information

1.1 Equipment description

FCC Equipment Class	Licensed Non-Broadcast Station Transmitter(TNB)
Equipment type	GPS Device
Equipment model name	GPS100MVPA
Equipment add model name	GPS-150CP
Equipment serial no.	Identical prototype
Tx Freq. Range	824.70 ~ 848.31 MHz
Rx Freq. Range	869.70 ~ 893.31 MHz
Max. Power Rating	0.329W ERP(25.17dBm)
Emission Designators	1M27F9W
Power	Battery: DC 3.7V

1.2 Ancillary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2. Information about test items

2.1 Test mode

This Device was tested in continuous transmitting mode.(at maximum power)

Test Case 1	Only EUT
Test Case 2	-

2.2 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
				-
				-

2.3 Tested environment

Temperature	:	23 ~ 24 °C
Relative humidity content	:	28 ~ 32 % R.H.
Details of power supply	:	DC 3.7 V

2.4 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. Description of tests

3.1 Effective radiated power & equivalent isotropic radiated power

These measurements were performed outdoors at 3meter test range. The equipment under test is placed on a wooden turntable 0.8-meters above the ground plane and 3-meters from the receive antenna.

The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer.

A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading.

For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.

3.2 Occupied bandwidth

The EUT was setup to maximum output power at its lowest channel. The occupied bandwidth was measured using a spectrum analyzer. The measurements are repeated for the highest and a middle channel. The EUT's occupied bandwidth is measured as the width of the signal between two points, one below the carrier center frequency and one above the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. Plots of the EUT's occupied bandwidth are shown herein.

3.3 Spurious and harmonic emissions at antenna terminal

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer.

The EUT was setup to maximum output power at its lowest channel. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. The Resolution BW of the analyzer is set to 1 % of the emission bandwidth to show compliance with -13dBm limit [43+10log(P)], in the 1 MHz bands immediately outside and adjacent to the edge of the frequency block.

A display line was placed at -13dBm to show compliance. The high, lowest and a middle channel were tested for out of band measurements.

Band Edge Requirement

In the 1MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions.

3.4 Radiation spurious and harmonic emissions

This measurement was performed outdoors at 3meter test range. The equipment under test is placed on a wooden turntable 0.8-meters above the ground plane and 3-meters from the receive antenna.

The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer.

For radiated power measurements below 1GHz, a half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading.

For radiated power measurements above 1GHz, a Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading. The difference between the gain of the horn and an isotropic antenna are taken into consideration.

This measurement was performed with the EUT oriented in 3 orthogonal axis.

3.5 Frequency stability/temperature variation.

The frequency stability of the transmitter is measured by:

a.) Temperature: The temperature is varied from - 30 °C to + 50 °C using an environmental chamber.

b.) Primary Supply Voltage: The primary supply voltage is varied from battery end point to 115 % of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification - the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ± 0.000 25 %(± 2.5 ppm) of the center frequency.

Time Period and Procedure:

The carrier frequency of the transmitter is measured at room temperature.(25°C to provide a reference).

1. The equipment is turned on in a “standby” condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.

2. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

4. Test rport

4.1 Summary of tests

FCC Part Section(s)	Parameter	Status Note 1
2.1046	Conducted Output Power	C
22.913(a)	Effective Radiated Power	C
22.917(a) 2.1049	Occupied Bandwidth	C
22.917(a) 2.1051	Band Edge Spurious and Harmonic Emissions at Antenna Terminal	C
22.917(a) 2.1053	Radiated Spurious and Harmonic Emissions	C
22.355 2.1055	Frequency Stability	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

The sample was tested according to the following specification:
ANSI C-63.4-2003, ANSI/TIA/EIA-603-C-2004

4.2 Test data

4.2.1 Conducted output power

The output power was measured under all R.C.s and S.O.s which are listed below measurement data. This device was tested under the worst case(**SO55** of **RC3** for **CELLULAR band**).

SAR Measurement Procedures for 3G Devices(Released October 2007)

- verify maximum output power
  - on high, middle and low channels
  - according to 3GPP2 C.S0011 / TIA-98-E, Sec. 4.4.5
- Power measurement configurations

1. 1xRRT
   - Test Mode 1(C.S0011 Table 4.4.5.2-1), SO55, RC1, Traffic Channel @9600bps
   - Test Mode 3(C.S0011 Table 4.4.5.2-2), SO55 or SO32, RC3, FCH @9600bps
   - Test Mode 3(C.S0011 Table 4.4.5.2-2), SO32, RC3, FCH+SCH @9600bps
   - other configurations supported by the DUT
   - power control
     - Bits Hold for FCH+SCH
     - otherwise ALL Bits Up
2. Ev-DO Rev.0
   - FTAP: 2 slot version of 307.2Kbps(ACK in all slots)
   - RTAP: 153.6Kbps in sub type 0/1 PHY Configuration
3. Ev-DO Rev.A
   - FETAP: 2 slot version of 307.2Kbps(ACK in all slots)
   - RETAP: 4096 bits payload with 16 slot termination target In Subtype 2PHY configuration

- Measurement data

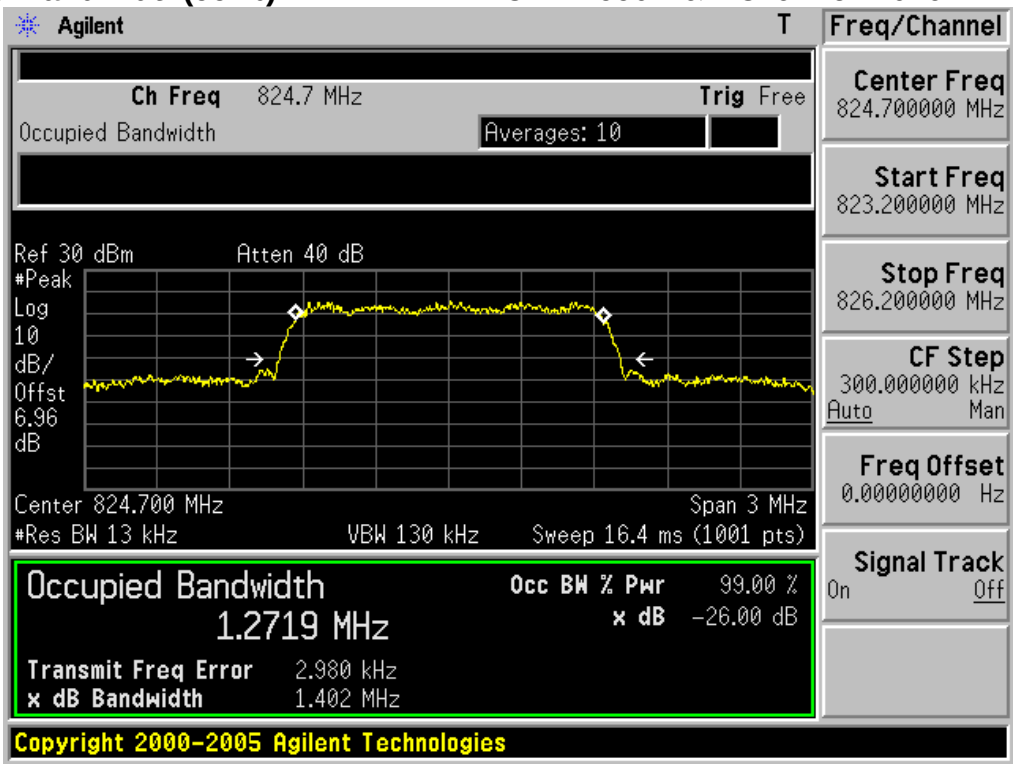
Band	Channel	1X RRT					EvDo (Rev.0)		EvDo (Rev.A)	
		RC1	RC1	RC3	RC3	RC3				
		SO2	SO55	SO2	SO55	SO32 (TDSO)	FTAP	RTAP	FETAP	RETAP
Cellular	**1013**	23.29	23.35	23.43	***23.48***	N/A	N/A	N/A	N/A	N/A
	0384	22.86	22.91	22.76	***22.95***	N/A	N/A	N/A	N/A	N/A
	0777	23.21	23.31	23.33	***23.41***	N/A	N/A	N/A	N/A	N/A

4.2.2 Occupied bandwidth(99%)

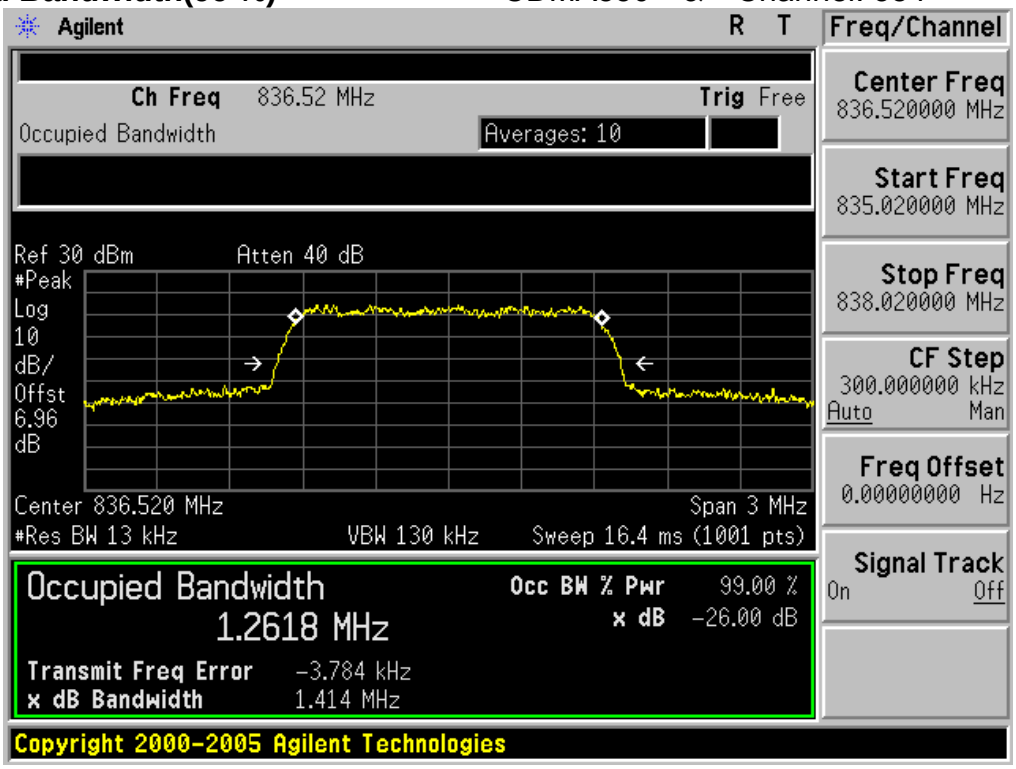
Band	Channel	Test Result(MHz)
Cellular	**1013**	1.2719
	384	1.2618
	777	1.2709

- Test Plots: Refer to next page.

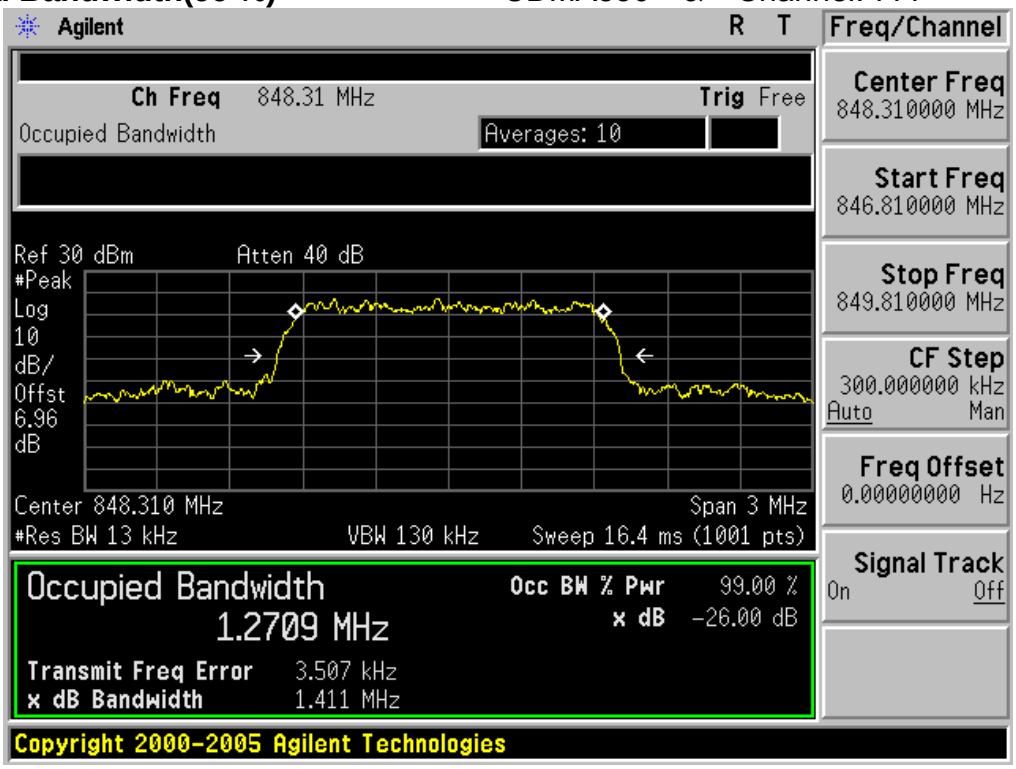
Occupied Bandwidth(99 %) CDMA850 & Channel: 1013



Occupied Bandwidth(99 %) CDMA850 & Channel: 384

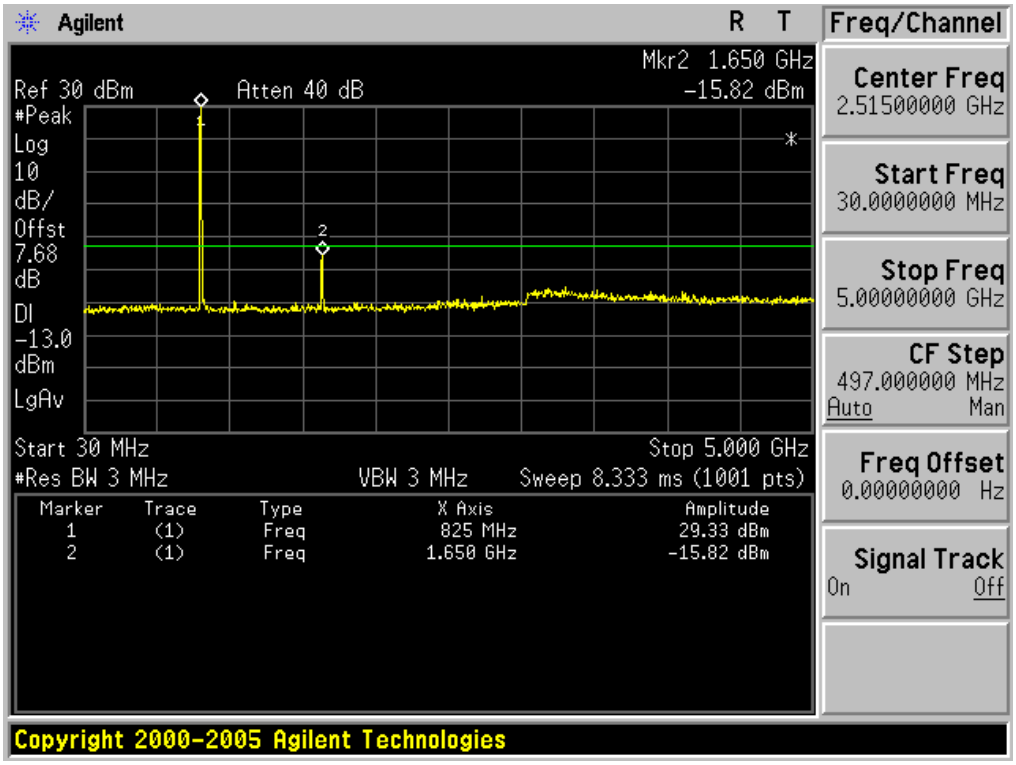


Occupied Bandwidth(99 %) CDMA850 & Channel: 777

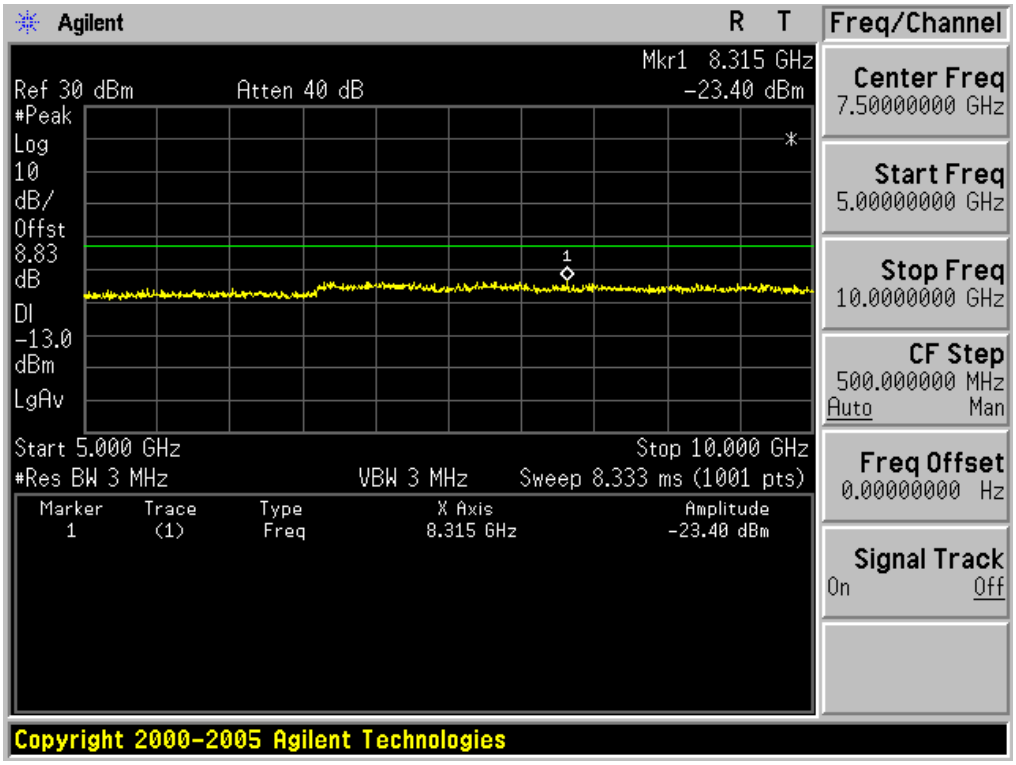


4.2.3 Spurious and harmonic emissions at antenna terminal

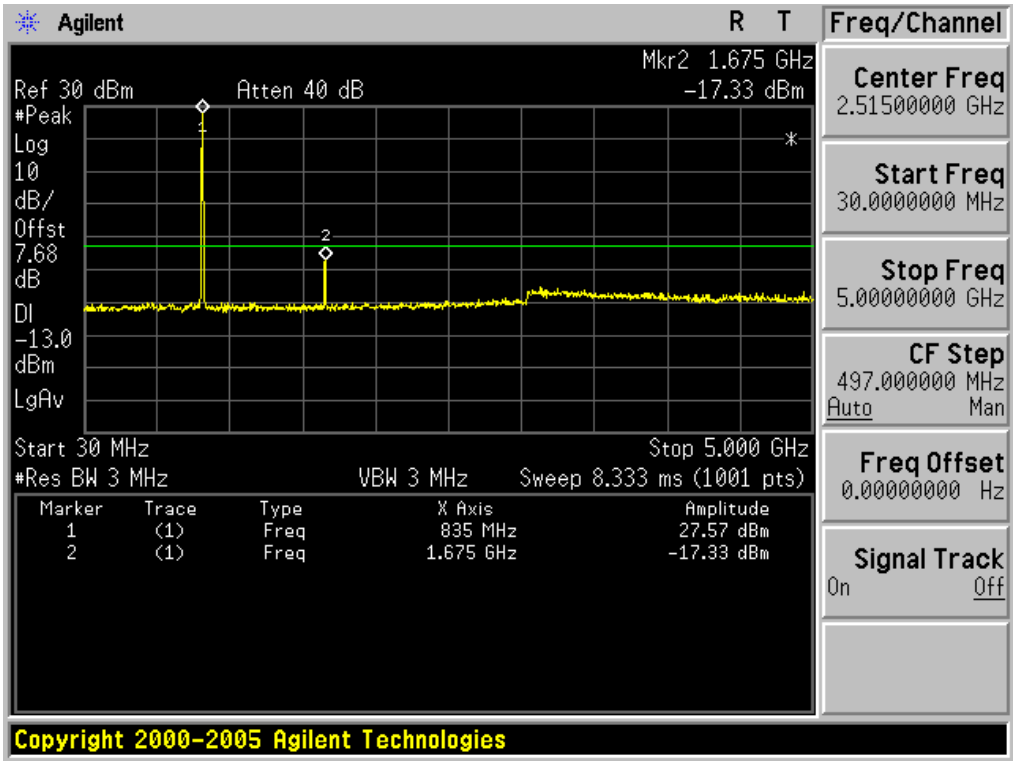
Spurious and Harmonic Emissions CDMA850 & Channel: 1013



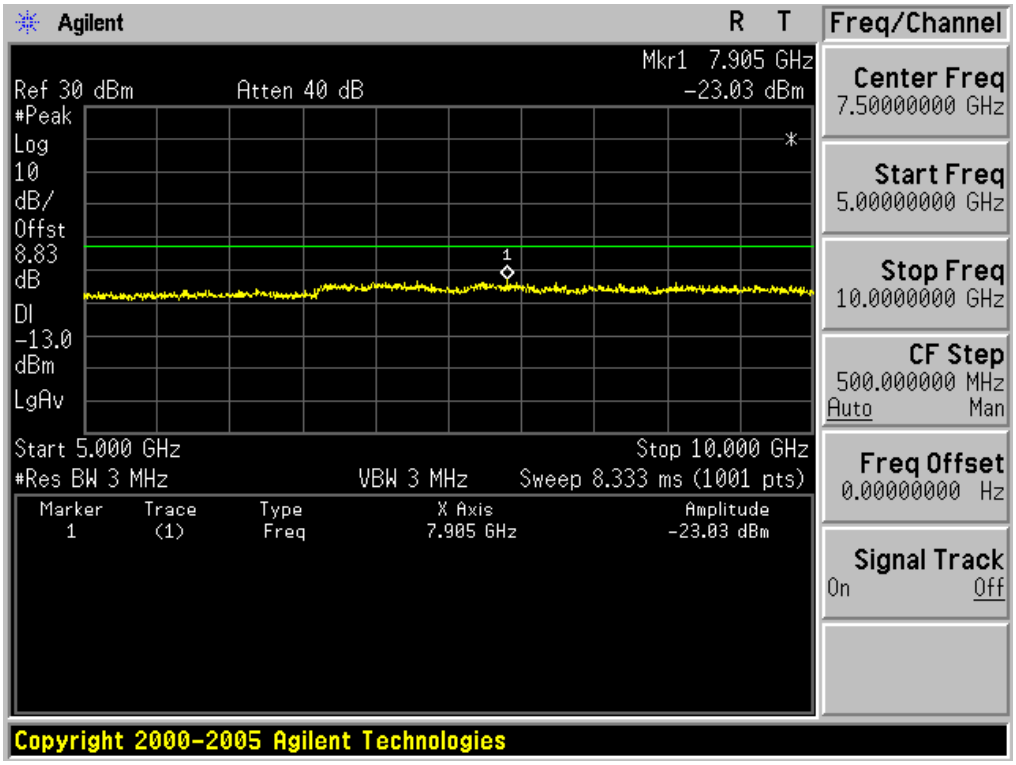
Spurious and Harmonic Emissions CDMA850 & Channel: 1013



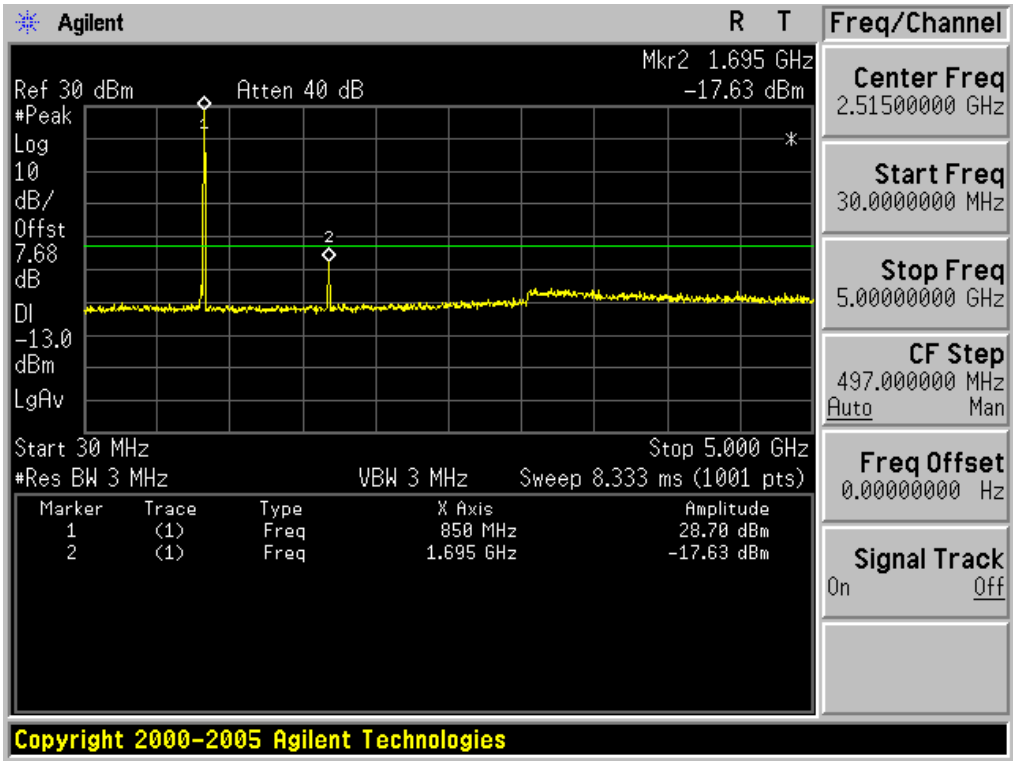
Spurious and Harmonic Emissions CDMA850 & Channel: 384



Spurious and Harmonic Emissions CDMA850 & Channel: 384



Spurious and Harmonic Emissions CDMA850 & Channel: 777



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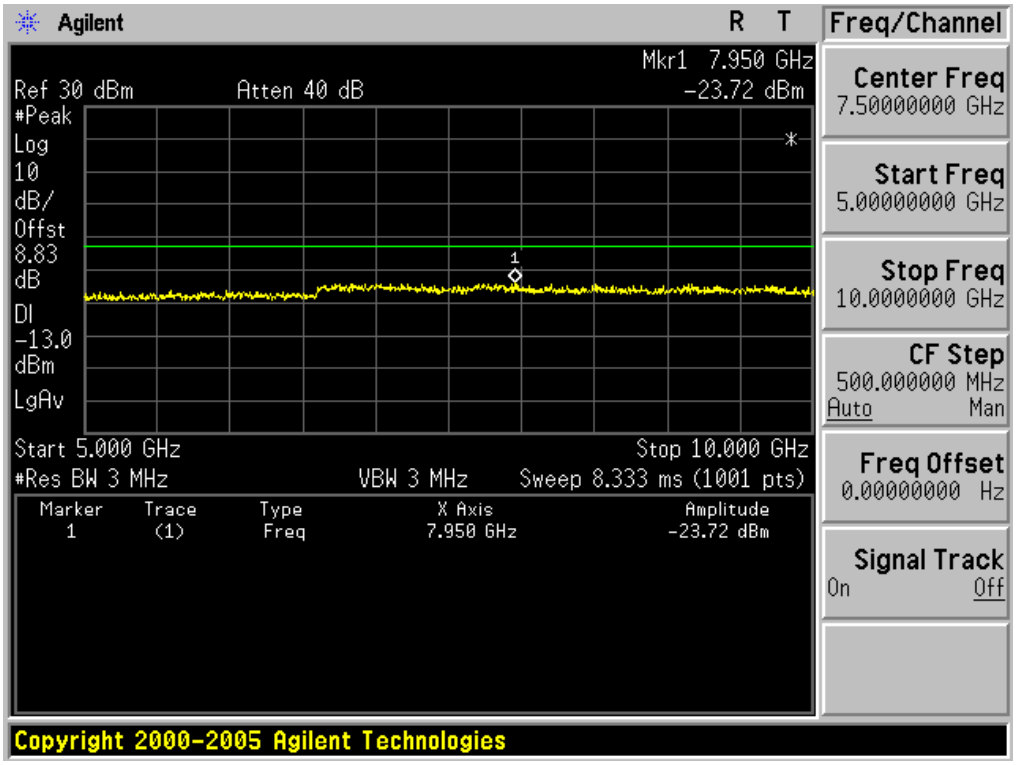
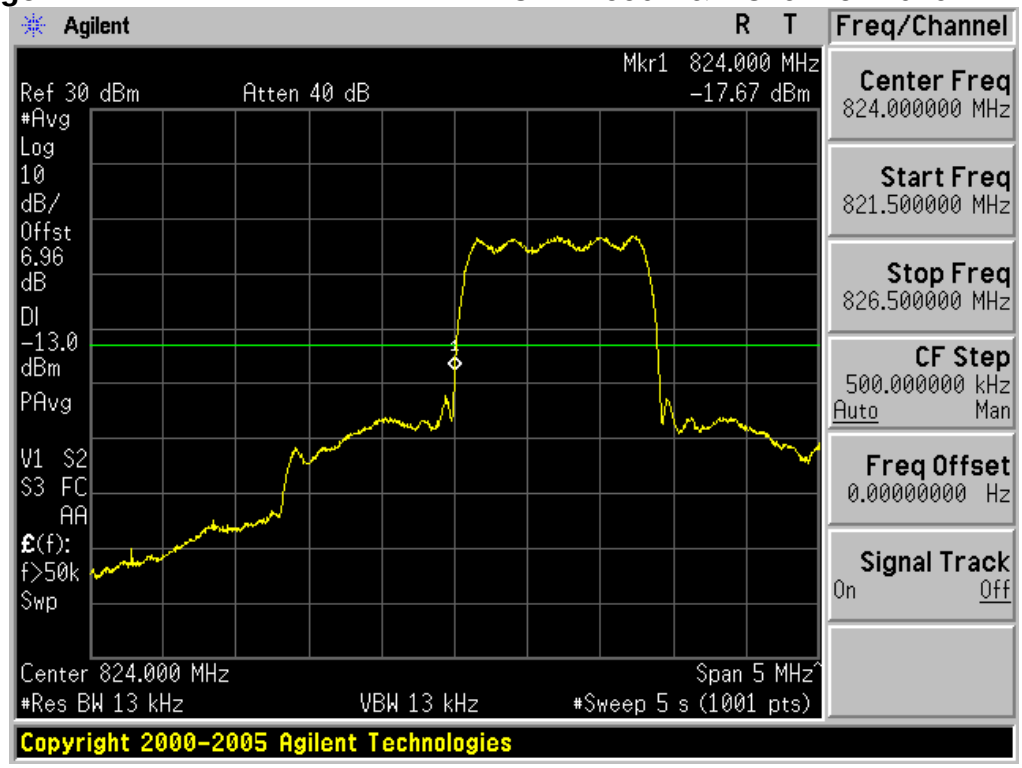
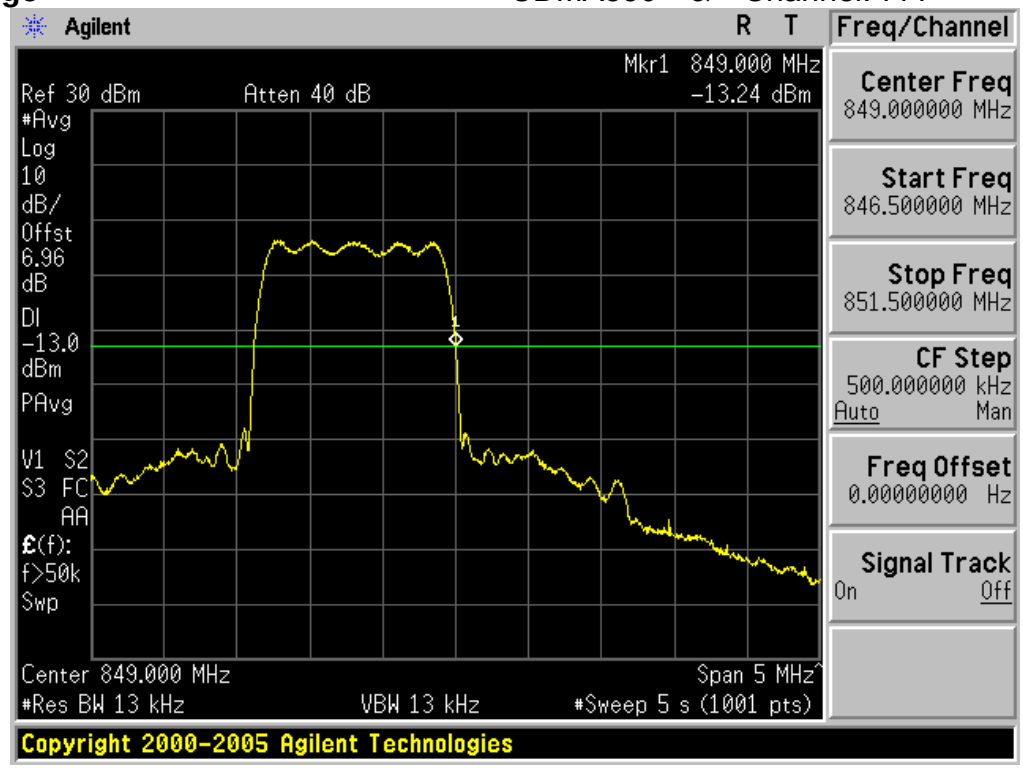


4.2.4 Band edge

Band Edge CDMA850 & Channel: 1013



Band Edge CDMA850 & Channel: 777



4.2.5 Effective Radiated Power(CDMA850)

Channel	EUT Position	Ref. level (dBm)	Pol. (H/V)	ERP (dBm)	ERP (W)	Power Supply	Note.
1013	***Y***	***-11.09***	***V***	***25.17***	***0.329***	***DC 3.7V***	**-**
384	Y	-12.50	V	22.16	0.164	DC 3.7V	-
777	Z	-11.01	H	23.38	0.218	DC 3.7V	-

NOTE

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer.

A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminals of the dipole is measured. The ERP is recorded.

For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

This test is performed with EUT oriented in 3 orthogonal axis and horizontal/vertical polarization of detecting antenna. The worst case data is reported.

4.2.6 Radiated spurious emissions(CDMA850)

CH.	Max. ERP (dBm)	Freq. (MHz)	EUT Pos. (Axis)	ANT Pol. (H/V)	LEVEL@ ANTENNA TERMINALS (dBm)	SUBSTITUTE ANTENNA GAIN (dBd)	CORRECT GENERATOR LEVEL (dBm)	(dBc)	Limit (dBc)
1013	25.17	1648.65	X	H	-53.19	7.18	-46.01	71.18	38.17
		-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	
384	22.16	1673.30	Y	H	-53.18	7.30	-45.88	68.04	35.16
		-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	
777	23.38	1696.97	X	H	-47.65	7.41	-40.24	63.62	36.38
		-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	
		-	-	-	-	-	-	-	

- Limit Calculation = 43 + 10 $\log_{10}$ (ERP [W]) [dBc]

  = 43 + ERP[dBm] -30

- Emissions were not reported greater than below 30dB of the Limit.

NOTE

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2004, Aug. 17, 2004:

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer.

A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

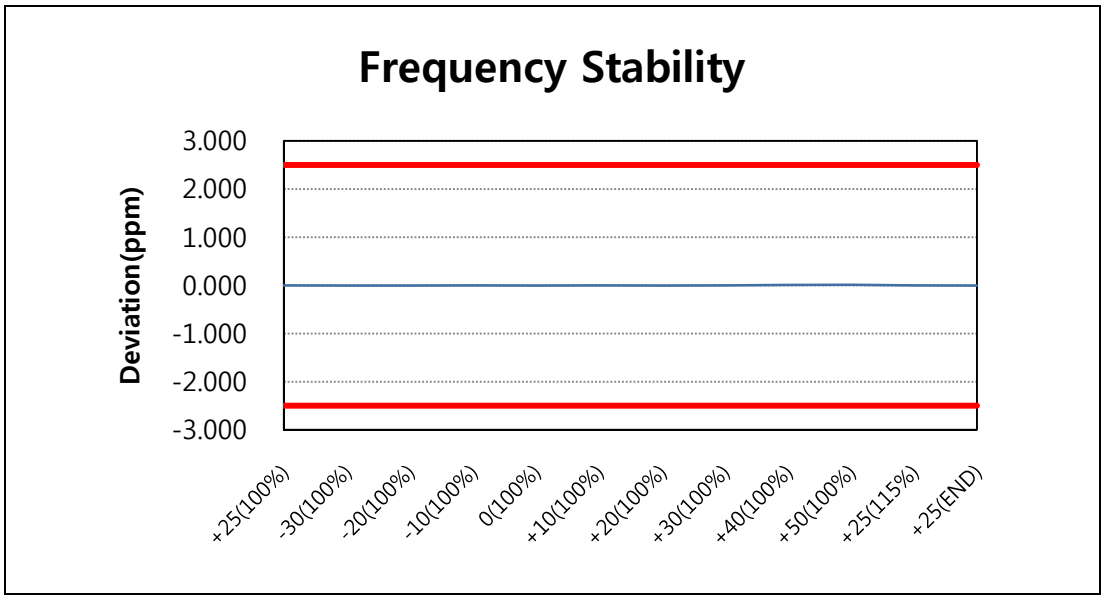
For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

This test is performed all axis of EUT and in horizontal/vertical polarization of detecting antenna. The worst case data is reported.

4.2.7 Frequency Stability(CDMA850)

OPERATING FREQUENCY : 836,519,996 Hz
CHANNEL : 0384(Mid)
REFERENCE VOLTAGE : 3.7 VDC
DEVIATION LIMIT : ± 0.00025 % or 2.5 ppm
:

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQ (Hz)	Deviation (ppm)
100%	3.7	+25(Ref)	836,519,996	0.000
100%		-30	836,519,992	-0.005
100%		-20	836,519,994	-0.002
100%		-10	836,519,995	-0.001
100%		0	836,519,994	-0.002
100%		+10	836,519,995	-0.001
100%		+20	836,519,994	-0.002
100%		+30	836,519,995	-0.001
100%		+40	836,520,005	0.011
100%		+50	836,520,006	0.012
85%	3.145	+25	N/A	N/A
115%	4.255	+25	836,519,997	0.001
BAT. END POINT	3.300	+25	836,519,994	-0.002



4.2.8 SAMPLE CALCULATIONS

A. Emission Designator

- Cellular Band -

Emission Designator = 1M27F9W

CDMA BW = 1.2719 MHz
F = Frequency Modulation
9 = Composite Digital Info
W = Combination (Audio/Data)
(Measured at the 99.75% power bandwidth)

APPENDIX

TEST EQUIPMENT FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

	Type	Manufacturer	Model	Cal.Date (dd/mm/yy)	Next.Cal.Date (dd/mm/yy)	S/N
☒	Spectrum Analyzer	Agilent	E4440A	30/09/10	30/09/11	MY45304199
☐	Spectrum Analyzer	Rohde Schwarz	FSQ26	11/01/11	11/01/12	200445
☐	Spectrum analyzer	Agilent	E4404B	08/03/11	08/03/12	US41061134
☐	Spectrum Analyzer(RE)	H.P	8563E	04/10/10	04/10/11	3551A04634
☐	MXA Signal Analyzer	Agilent Technologies, Inc	N9020A	07/01/11	07/01/12	MY49100833
☐	Power Meter	H.P	EPM-442A	01/07/10	01/07/11	GB37170413
☐	Power Sensor	H.P	8481A	01/07/10	01/07/11	3318A96332
☐	Power Divider	Agilent	11636B	05/10/10	05/10/11	56471
☐	4-Way Power Divider	ET Industries	D-0526-4	24/12/10	24/12/11	210195001
☒	Power Splitter	Anritsu	K241B	05/10/10	05/10/11	020611
☐	Power Splitter	Anritsu	K241B	01/07/10	01/07/11	017060
☐	Power Splitters & Dividers	Aeroflex/Weinschel	1594	21/02/11	21/02/12	1177
☐	Frequency Counter	H.P	5342A	01/07/10	01/07/11	2119A04450
☒	TEMP & HUMIDITY Chamber	JISCO	KR-100/J-RHC2	04/10/10	04/10/11	30604493/021031
☒	Digital Multimeter	H.P	34401A	07/03/11	07/03/12	3146A13475, US36122178
☐	Multifunction Synthesizer	HP	8904A	11/10/10	11/10/11	3633A08404
☒	Signal Generator	Rohde Schwarz	SMR20	08/03/11	08/03/12	101251
☒	Signal Generator	H.P	ESG-3000A	01/07/10	01/07/11	US37230529
☐	Vector Signal Generator	Rohde Schwarz	SMJ100A	11/01/11	11/01/12	100148
☐	Vector Signal Generator	Rohde Schwarz	SMBV100A	11/01/11	11/01/12	255571
☐	Audio Analyzer	H.P	8903B	02/07/10	02/07/11	3011A09448
☐	Modulation Analyzer	H.P	8901B	01/07/10	01/07/11	3028A03029
☒	8960 Series 10 Wireless Comms. Test Set	Agilent	E5515C	07/03/11	07/03/12	GB43461134
☐	Universal Radio communication Tester	Rohde Schwarz	CMU200	07/03/11	07/03/12	106760
☐	Bluetooth Tester	TESCOM	TC-3000B	01/07/10	01/07/11	3000B000268
☒	Thermo hygrometer	BODYCOM	BJ5478	13/01/11	13/01/12	090205-3
☐	Thermo hygrometer	BODYCOM	BJ5478	13/01/11	13/01/12	090205-2
☐	Thermo hygrometer	BODYCOM	BJ5478	13/01/11	13/01/12	090205-4
☐	AC Power supply	DAEKWANG	5KVA	08/03/11	08/03/12	20060321-1
☒	DC Power Supply	HP	6622A	07/03/11	07/03/12	3448A03760
☐	DC Power Supply	HP	6633A	07/03/11	07/03/12	3524A06634
☐	DC Power Supply	Protek	PWS-3010D	04/10/10	04/10/11	4072702
☒	BAND Reject Filter	Microwave Circuits	N0308372	05/10/10	05/10/11	3125-01DC0352
☐	BAND Reject Filter	Wainwright	WRCG1750	05/10/10	05/10/11	2
☐	High-Pass Filter	ANRITSU	MP526D	04/10/10	04/10/11	M27756
☐	High-pass filter	Wainwright	WHNX2.1	N/A	N/A	1
☐	High-pass filter	Wainwright	WHNX3.0	N/A	N/A	9
☐	High-pass filter	Wainwright	WHNX5.0	N/A	N/A	8

	Type	Manufacturer	Model	Cal.Date (dd/mm/yy)	Next.Cal.Date (dd/mm/yy)	S/N
☐	High-Pass Filter	Wainwright	WHKX8.5	N/A	N/A	1
☒	High-Pass Filter	Wainwright	D82346	N/A	N/A	9
☐	Tunable Notch Filter	Wainwright	WRCT800.0 /960.0-0.2/40-8SSK	N/A	N/A	32
☐	Tunable Notch Filter	Wainwright	WRCD1700.0 /2000.0-0.2/40-10SSK	N/A	N/A	53
☐	Tunable Notch Filter	Wainwright	WRCT1900.0/ 2200.0-5/40-10SSK	N/A	N/A	30
☒	HORN ANT	ETS	3115	04/10/10	04/10/11	21097
☐	HORN ANT	ETS	3115	14/07/10	14/07/11	6419
☐	HORN ANT	A.H.Systems	SAS-574	10/06/09	10/06/11	154
☐	HORN ANT	A.H.Systems	SAS-574	10/06/09	10/06/11	155
☒	HORN ANT	SCHWARZBECK	BBHA9120A	13/04/10	13/04/12	322
☒	Dipole Antenna	Schwarzbeck	VHA9103	29/11/10	29/11/11	2116
☒	Dipole Antenna	Schwarzbeck	VHA9103	29/11/10	29/11/11	2117
☒	Dipole Antenna	Schwarzbeck	UHA9105	29/11/10	29/11/11	2261
☒	Dipole Antenna	Schwarzbeck	UHA9105	29/11/10	29/11/11	2262
☐	LOOP Antenna	ETS	6502	29/10/10	29/10/11	3471
☐	Coaxial Fixed Attenuators	Agilent	8491B	01/07/10	01/07/11	MY39260700
☒	Attenuator (3dB)	WEINSCHEL	56-3	05/10/10	05/10/11	Y2342
☐	Attenuator (3dB)	WEINSCHEL	56-3	05/10/10	05/10/11	Y2370
☒	Attenuator (10dB)	WEINSCHEL	23-10-34	01/10/10	01/10/11	BP4386
☐	Attenuator (10dB)	WEINSCHEL	23-10-34	11/01/11	11/01/12	BP4387
☐	Attenuator (10dB)	WEINSCHEL	86-10-11	05/10/10	05/10/11	446
☐	Attenuator (10dB)	WEINSCHEL	86-10-11	05/10/10	05/10/11	408
☐	Attenuator (20dB)	WEINSCHEL	86-20-11	05/10/10	05/10/11	432
☐	Attenuator (30dB)	JFW	50FH-030-300	07/03/11	07/03/12	060320-1
☐	Attenuator (40dB)	WEINSCHEL	57-40-33	01/10/10	01/10/11	NN837
☐	Termination	H.P	HP-909D	02/07/10	02/07/11	02750
☐	Termination	H.P	HP-909D	02/07/10	02/07/11	02702
☐	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0088CAN	01/07/10	01/07/11	788
☐	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0185CAN	01/07/10	01/07/11	790
☐	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0215CAN	01/07/10	01/07/11	112
☒	Amplifier (30dB)	Agilent	8449B	07/03/11	07/03/12	3008A01590
☐	Amplifier (30dB)	H.P	8449B	07/03/11	07/03/12	3008A00370
☒	Amplifier	EMPOWER	BBS3Q7ELU	04/10/10	04/10/11	1020
☐	RF Power Amplifier	OPHIRRF	5069F	01/07/10	01/07/11	1006
☐	EMI TEST RECEIVER	R&S	ESU	20/01/11	20/01/12	100014
☐	BILOG ANTENNA	SCHAFFNER	CBL6112B	14/07/10	14/07/11	2737
☐	Amplifier (22dB)	H.P	8447E	11/01/11	11/01/12	2945A02865
☐	EMI TEST RECEIVER	R&S	ESCI	08/03/11	08/03/12	100364

	Type	Manufacturer	Model	Cal.Date (dd/mm/yy)	Next.Cal.Date (dd/mm/yy)	S/N
☐	BICONICAL ANT.	Schwarzbeck	VHA 9103	29/11/10	29/11/11	91032789
☒	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	29/11/10	29/11/12	1098
☒	BICONICAL ANT.	Schwarzbeck	VHA 9103	21/12/10	21/12/12	91031946
☐	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	07/07/10	07/07/11	0590
☐	Low Noise Pre Amplifier	TSJ	MLA-100K01-B01-2	07/03/11	07/03/12	1252741
☐	Low Noise Pre Amplifier	TSJ	MLA-00108-B02-36	11/01/11	11/01/12	1518831
☒	Amplifier (25dB)	Agilent	8447D	07/03/11	07/03/12	2944A10144
☐	Amplifier (25dB)	Agilent	8447D	01/07/10	01/07/11	2648A04922
☐	Spectrum Analyzer(CE)	H.P	8591E	07/03/11	07/03/12	3649A05889
☐	LISN	Kyoritsu	KNW-407	11/01/11	11/01/12	8-317-8
☐	LISN	Kyoritsu	KNW-242	02/07/10	02/07/11	8-654-15
☐	CVCF	NF Electronic	4420	08/03/11	08/03/12	304935/337980
☐	50 ohm Terminator	HME	CT-01	11/01/11	11/01/12	N/A
☐	RFI/FIELD Intensity Meter	Kyoritsu	KNM-2402	02/07/10	02/07/11	4N-170-3
☐	Wideband Radio Communication Tester	R&S	CMW500	21/10/10	21/10/11	100988