

RF TEST REPORT

Test item : Transmitter Ass'y - Smart Key
Model No. : MT FOBG 01
Order No. : 1202-00240
Date of receipt : 2012-02-10
Test duration : 2012-03-14 ~ 2012-03-20
Date of issue : 2012-03-20
Use of report : FCC Original Grant

Applicant : MOTOTECH Co., Ltd..
#451-8, Gwiraе-ri, Jeongnam-myeon, Hwasong-si, Gyeonggi-do, 445-961,
Korea

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

Test specification : FCC Part 15 Subpart C
Test environment : See appended test report
Test result : Pass Fail

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DIGITAL EMC CO., LTD.

Tested by:



Engineer
S.K. Ryu

Witnessed by:

N/A

N/A

Reviewed by:



Technical Director
Harvey Sung

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1. Equipment information

1.1 Equipment description

FCC Equipment Class	Part 15 Low Power Transmitter
Equipment type	Transmitter for door keyless controller of Vehicle (Smart Key)
Fundamental Frequency	433.92 MHz
Equipment model name	MT FOBG 01
Modulation	FSK
Equipment serial no.	Identical prototype
Power	DC 3 V(Battery)
Antenna type	Fixed type (Pattern Antenna)

1.2 Ancillary equipment

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

2. Information about test items

2.1 Operating mode

Operating Mode 1	This device was tested with continuous TX mode for field strength of fundamental and spurious emissions measurements.
Operating Mode 2	Normal operating mode was used for 20 dB BW and less than 5 second requirements.

2.2 Tested frequency

Item	TX
Frequency	433.92 MHz

2.3 Auxiliary equipment

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

2.4 Tested environment

Temperature	: 22 ~ 24 °C
Relative humidity content	: 32 ~ 35 % R.H.
Details of power supply	: DC 3 V(Battery)

2.5 EMI Suppression Device(s)/Modifications

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

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Test Condition	Status Note 1
I. Test Items			
15.205	Restricted bands of operation	Radiated	C
15.209	Radiated emission limits, general requirements		C
15.231	Periodic operation characteristics Fundamental frequencies / Field strength limits 20 dB Bandwidth		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

3.2 Transmitter requirements

3.2.1 20dB Bandwidth Measurement

- Procedure:

The Transmitter output is connected to the spectrum analyzer.

20dB Bandwidth : The RBW is set to 100 KHz. The VBW is set to 100 KHz. The sweep time is coupled. Bandwidth is determined at the points 20 dB down from the modulated carrier.

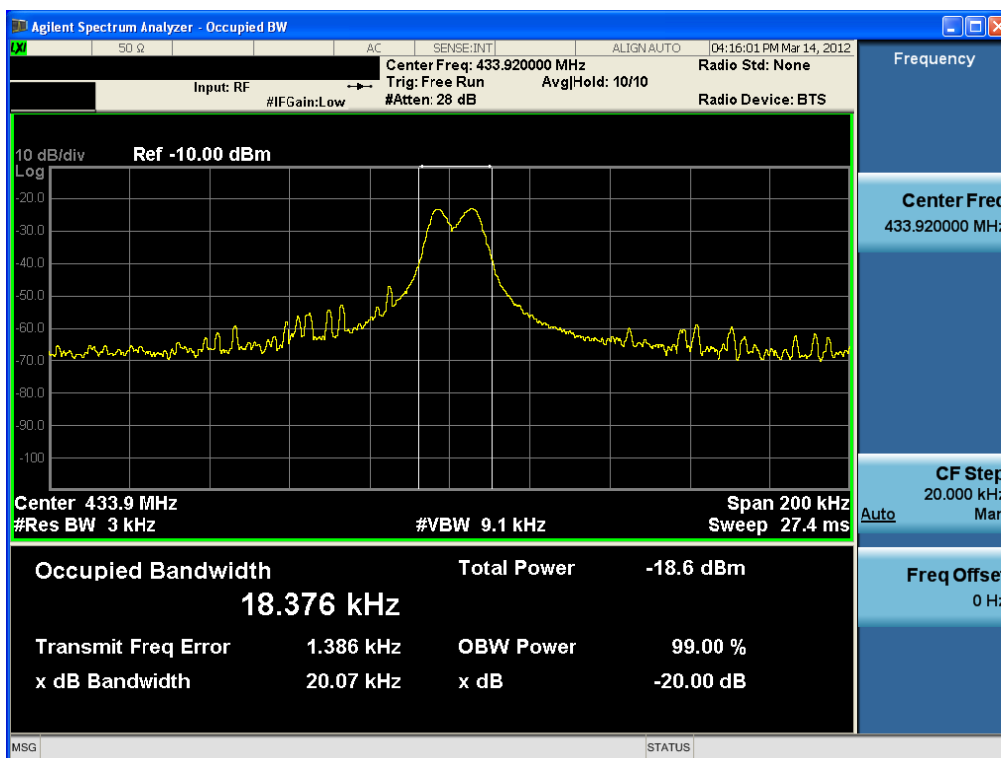
99% Bandwidth : The RBW is set to 1% to 3% of the 99% bandwidth. The VBW is set to 3times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

- Measurement Data: **Comply**

20dB Bandwidth & 99% Bandwidth

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit (kHz)
433.92	20.07	18.376	1084.8

20dB Bandwidth & 99% Bandwidth



- Minimum Standard:

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

3.2.2 Radiated Emissions

§ 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	3600 ~ 4400	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	4.5 ~ 5.15	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	5.35 ~ 5.46	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~	1660 ~ 1710	7.25 ~ 7.75	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.52525	1718.8 ~ 1722.2	8.025 ~ 8.5	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	156.7 ~ 156.9	2200 ~ 2300	9.0 ~ 9.2	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	162.0125 ~ 167.17	2310 ~ 2390	9.3 ~ 9.5	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	167.72 ~ 173.2	2483.5 ~ 2500	10.6 ~ 12.7	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	240 ~ 285	2655 ~ 2900	13.25 ~ 13.4	
8.291 ~ 8.294	37.5 ~ 38.25	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	608 ~ 614	3345.8 ~ 3358		
		960 ~ 1240			

§ 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency [MHz]	Field Strength of Fundamental Frequency [uV/m]	Measurement Distance [m]
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

§ 15.231(b), In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Frequency [MHz]	Field Strength of Fundamental Frequency [uV/m]	Field Strength of Spurious Emissions [uV/m]
40.66 ~ 40.70	2,250	225
70 ~ 130	1,250	125
130 ~ 174	1,250 to 3,750	125 to 375
174 ~ 260	3,750	375
260 ~ 470	3,750 to 12,500	375 to 1,250
Above 470	12,500	1,250

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

- Procedure: ANCI C63.4

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

- Measurement Data: Comply**Field strength of fundamental (Section 15.231(b))**

Measurement Distance : 3 m

EUT Position	Frequency [MHz]	Detector Mode	ANT Pol	Reading [dBuV]	T.F [dB/m]	Averaging correction factor [dB]	Field Strength [dBuV/m]	Average Limit [dBuV/m]
X	433.920	PK	Hor	82.17	-4.80	0.00	77.37	80.80
X	433.920	PK	Ver	68.04	-4.80	0.00	63.24	80.80
Y	433.920	PK	Hor	69.59	-4.80	0.00	64.79	80.80
Y	433.920	PK	Ver	77.33	-4.80	0.00	72.53	80.80
Z	433.920	PK	Hor	80.14	-4.80	0.00	75.34	80.80
Z	433.920	PK	Ver	73.51	-4.80	0.00	68.71	80.80

Note 1 : EUT was in continuous transmission mode and peak field strength meets AV limit.
Therefore averaging correction factor using the duty cycle is not required.

TRANSMITTER HARMONICS AND SPURIOUS RADIATION (Section 15.205, 15.209).

Measurement Distance : 3 m

EUT Position	Frequency [MHz]	Detector Mode	ANT Pol	Reading [dBuV]	T.F [dB/m]	Averaging correction factor [dB]	Field Strength [dBuV/m]	Average Limit [dBuV/m]
X	1737.170	PK	Hor	51.80	-10.00	0.00	41.80	60.80
X	2169.870	PK	Ver	57.30	-8.50	0.00	48.80	60.80
X	2602.570	PK	Hor	51.80	-6.30	0.00	45.50	60.80

Note 1. EUT was in continuous transmission mode and peak field strength meets AV limit.
Note 2. No other spurious and harmonic emissions were reported greater than listed emissions above table.
Note 3. Sample calculation

$$T.F = AF + CL - AG$$

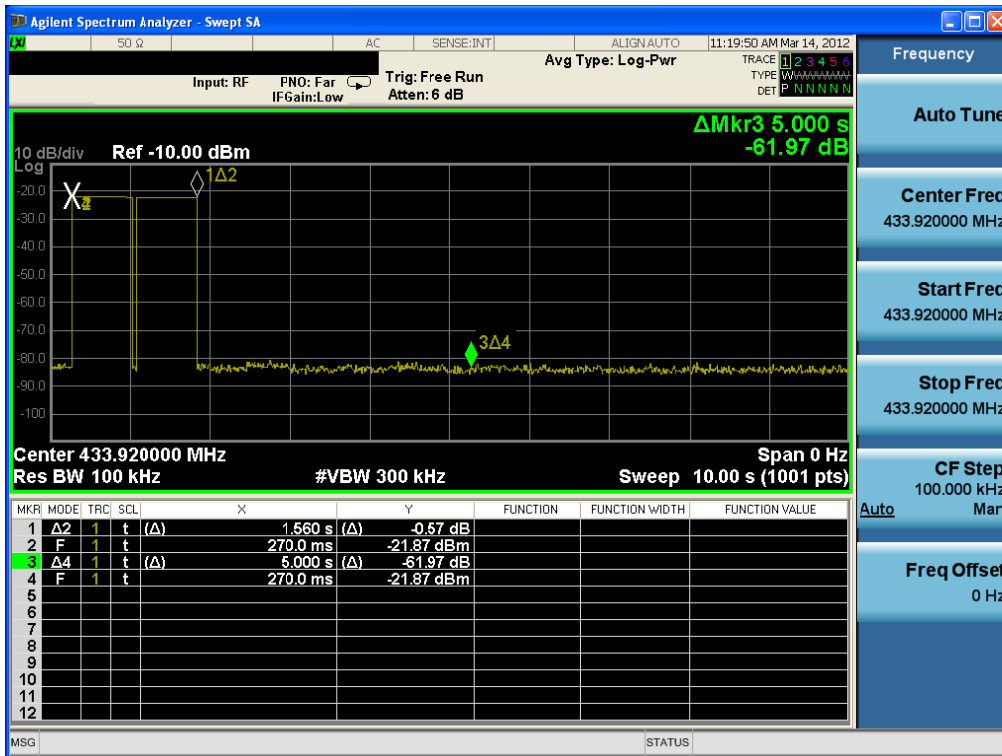
$$/ \quad \text{Field Strength} = \text{Reading} + T.F + DF$$

$$\text{Margin} = \text{Limit} - \text{Field Strength}$$

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

3.2.3 Less than 5 seconds plot

Transmitting Time Periodic < 5 seconds



APPENDIX I

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 (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
<input checked="" type="checkbox"/>	Spectrum Analyzer	Agilent	E4440A	11/09/30	12/09/30	MY45304199
<input type="checkbox"/>	Spectrum Analyzer	Rohde Schwarz	FSQ26	12/01/09	13/01/09	200445
<input type="checkbox"/>	Spectrum analyzer	Agilent	E4404B	12/03/05	13/03/05	US41061134
<input type="checkbox"/>	Spectrum Analyzer(RE)	H.P	8563E	11/10/04	12/10/04	3551A04634
<input type="checkbox"/>	MXA Signal Analyzer	Agilent Technologies, Inc	N9020A	12/01/09	13/01/09	MY49100833
<input type="checkbox"/>	Power Meter	H.P	EPM-442A	11/07/01	12/07/01	GB37170413
<input type="checkbox"/>	Power Sensor	H.P	8481A	11/07/01	12/07/01	3318A96332
<input type="checkbox"/>	Wideband Power Sensor	Rohde Schwarz	NRP-Z81	11/06/04	12/06/04	1137.9009.02-101001
<input type="checkbox"/>	Virtual Power Meter(S/W)	Rohde Schwarz	R&S Power Viewer Plus	-	-	V 4.1.0
<input type="checkbox"/>	Power Divider	Agilent	11636B	11/09/30	12/09/30	56471
<input type="checkbox"/>	4-Way Power Divider	ET Industries	D-0526-4	11/12/01	12/12/01	210195001
<input type="checkbox"/>	Power Splitter	Anritsu	K241B	11/09/30	12/09/30	020611
<input type="checkbox"/>	Power Splitter	Anritsu	K241B	11/07/01	12/07/01	017060
<input type="checkbox"/>	Frequency Counter	H.P	5342A	11/07/01	12/07/01	2119A04450
<input type="checkbox"/>	TEMP & HUMIDITY Chamber	JISCO	KR-100/J-RHC2	11/09/30	12/09/30	30604493/021031
<input type="checkbox"/>	Digital Multimeter	H.P	34401A	12/03/05	13/03/05	3146A13475, US36122178
<input type="checkbox"/>	Multifunction Synthesizer	HP	8904A	11/10/06	12/10/06	3633A08404
<input type="checkbox"/>	Signal Generator	Rohde Schwarz	SMR20	12/03/05	13/03/05	101251
<input type="checkbox"/>	Signal Generator	H.P	ESG-3000A	11/07/01	12/07/01	US37230529
<input type="checkbox"/>	Vector Signal Generator	Rohde Schwarz	SMJ100A	12/01/09	13/01/09	100148
<input type="checkbox"/>	Vector Signal Generator	Rohde Schwarz	SMBV100A	12/01/09	13/01/09	255571
<input type="checkbox"/>	Audio Analyzer	H.P	8903B	11/07/02	12/07/02	3011A09448
<input type="checkbox"/>	Modulation Analyzer	H.P	8901B	11/07/01	12/07/01	3028A03029
<input type="checkbox"/>	8960 Series 10 Wireless Comms. Test Set	Agilent	E5515C	12/03/05	13/03/05	GB43461134
<input type="checkbox"/>	Universal Radio communication Tester	Rohde Schwarz	CMU200	12/03/06	13/03/06	106760
<input type="checkbox"/>	Bluetooth Tester	TESCOM	TC-3000B	11/07/01	12/07/01	3000B000268
<input type="checkbox"/>	Thermo hygrometer	BODYCOM	BJ5478	12/01/13	13/01/13	090205-3
<input type="checkbox"/>	Thermo hygrometer	BODYCOM	BJ5478	12/01/13	13/01/13	090205-2
<input type="checkbox"/>	Thermo hygrometer	BODYCOM	BJ5478	12/01/13	13/01/13	090205-4
<input type="checkbox"/>	AC Power supply	DAEKWANG	5KVA	12/03/05	13/03/05	20060321-1
<input type="checkbox"/>	DC Power Supply	HP	6622A	12/03/05	13/03/05	3448A03760
<input type="checkbox"/>	DC Power Supply	HP	6633A	12/03/05	13/03/05	3524A06634
<input type="checkbox"/>	DC Power Supply	Protek	PWS-3010D	11/09/30	12/09/30	4072702
<input type="checkbox"/>	DC Power Supply	SM techno	SDP30-5D	11/05/20	12/05/20	305DKA013
<input type="checkbox"/>	BAND Reject Filter	Microwave Circuits	N0308372	11/09/30	12/09/30	3125-01DC0352
<input type="checkbox"/>	BAND Reject Filter	Wainwright	WRCG1750	11/09/30	12/09/30	2
<input type="checkbox"/>	High-Pass Filter	ANRITSU	MP526D	11/09/30	12/09/30	M27756

	Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
<input type="checkbox"/>	High-pass filter	Wainwright	WHNX2.1	11/09/30	12/09/30	1
<input type="checkbox"/>	High-pass filter	Wainwright	WHNX3.0	11/09/30	12/09/30	9
<input type="checkbox"/>	High-pass filter	Wainwright	WHNX5.0	11/09/19	12/09/19	8
<input type="checkbox"/>	High-Pass Filter	Wainwright	WHKX8.5	11/09/19	12/09/19	1
<input type="checkbox"/>	High-Pass Filter	Wainwright	WHKX1.0	11/09/30	12/09/30	9
<input type="checkbox"/>	Tunable Notch Filter	Wainwright	WRCT800.0 /960.0-0.2/40-8SSK	N/A	N/A	32
<input type="checkbox"/>	Tunable Notch Filter	Wainwright	WRCD1700.0 /2000.0-0.2/40-10SSK	N/A	N/A	53
<input type="checkbox"/>	Tunable Notch Filter	Wainwright	WRCT1900.0/ 2200.0-5/40-10SSK	N/A	N/A	30
<input checked="" type="checkbox"/>	HORN ANT	ETS	3115	11/09/06	12/09/06	21097
<input type="checkbox"/>	HORN ANT	ETS	3115	11/03/22	12/03/22	6419
<input type="checkbox"/>	HORN ANT	A.H.Systems	SAS-574	11/03/25	13/03/25	154
<input type="checkbox"/>	HORN ANT	A.H.Systems	SAS-574	11/03/25	13/03/25	155
<input type="checkbox"/>	HORN ANT	SCHWARZBECK	BBHA9120A	10/04/13	12/04/13	322
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	VHA9103	11/11/22	12/11/22	2116
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	VHA9103	11/11/22	12/11/22	2117
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	UHA9105	11/11/22	12/11/22	2261
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	UHA9105	11/11/22	12/11/22	2262
<input checked="" type="checkbox"/>	LOOP Antenna	ETS	6502	10/10/29	12/10/29	3471
<input type="checkbox"/>	Coaxial Fixed Attenuators	Agilent	8491B	11/07/02	12/07/02	MY39260700
<input type="checkbox"/>	Attenuator (3dB)	WEINSCHHEL	56-3	11/09/30	12/09/30	Y2342
<input type="checkbox"/>	Attenuator (3dB)	WEINSCHHEL	56-3	11/09/30	12/09/30	Y2370
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	23-10-34	11/09/30	12/09/30	BP4386
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	23-10-34	12/01/09	13/01/09	BP4387
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	86-10-11	11/09/30	12/09/30	446
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	86-10-11	11/09/30	12/09/30	408
<input type="checkbox"/>	Attenuator (20dB)	WEINSCHHEL	86-20-11	11/09/30	12/09/30	432
<input type="checkbox"/>	Attenuator (30dB)	JFW	50FH-030-300	12/03/05	13/03/05	060320-1
<input type="checkbox"/>	Attenuator (40dB)	WEINSCHHEL	57-40-33	11/09/30	12/09/30	NN837
<input type="checkbox"/>	Termination	H.P	HP-909D	11/07/02	12/07/02	02750
<input type="checkbox"/>	Termination	H.P	HP-909D	11/07/02	12/07/02	02702
<input type="checkbox"/>	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0088CAN	11/07/01	12/07/01	788
<input type="checkbox"/>	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0185CAN	11/07/01	12/07/01	790
<input type="checkbox"/>	Amplifier (30dB)	Agilent	8449B	12/03/05	13/03/05	3008A01590
<input checked="" type="checkbox"/>	Amplifier (30dB)	H.P	8449B	12/03/05	13/03/05	3008A00370
<input type="checkbox"/>	Amplifier	EMPOWER	BBS3Q7ELU	11/09/30	12/09/30	1020
<input type="checkbox"/>	RF Power Amplifier	OPHIRRF	5069F	11/07/01	12/07/01	1006
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	R&S	ESU	12/01/09	13/01/09	100014

	Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
<input checked="" type="checkbox"/>	BILOG ANTENNA	SCHAFFNER	CBL6112B	10/07/14	12/07/14	2737
<input checked="" type="checkbox"/>	Amplifier (22dB)	H.P	8447E	12/01/09	13/01/09	2945A02865
<input type="checkbox"/>	EMI TEST RECEIVER	R&S	ESCI	12/03/05	13/03/05	100364
<input type="checkbox"/>	BICONICAL ANT.	Schwarzbeck	VHA 9103	10/11/29	12/11/29	91032789
<input type="checkbox"/>	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	10/11/29	12/11/29	1098
<input type="checkbox"/>	BICONICAL ANT.	Schwarzbeck	VHA 9103	10/12/21	12/12/21	91031946
<input type="checkbox"/>	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	10/07/07	12/07/07	0590
<input type="checkbox"/>	Low Noise Pre Amplifier	TSJ	MLA-100K01-B01-2	12/03/05	13/03/05	1252741
<input type="checkbox"/>	Low Noise Pre Amplifier	TSJ	MLA-00108-B02-36	12/01/09	13/01/09	1518831
<input type="checkbox"/>	Amplifier (25dB)	Agilent	8447D	12/03/05	13/03/05	2944A10700
<input type="checkbox"/>	Amplifier (25dB)	Agilent	8447D	11/07/01	12/07/01	2648A04922
<input type="checkbox"/>	Spectrum Analyzer(CE)	H.P	8591E	12/03/05	13/03/05	3649A05889
<input type="checkbox"/>	LISN	Kyoritsu	KNW-407	12/01/09	13/01/09	8-317-8
<input type="checkbox"/>	LISN	Kyoritsu	KNW-242	11/07/02	12/07/02	8-654-15
<input type="checkbox"/>	CVCF	NF Electronic	4420	11/09/15	12/19/15	304935/4420023
<input type="checkbox"/>	50 ohm Terminator	HME	CT-01	12/01/09	13/01/09	N/A
<input type="checkbox"/>	RFI/FIELD Intensity Meter	Kyoritsu	KNM-2402	11/07/02	12/07/02	4N-170-3
<input type="checkbox"/>	EMI Test Receiver	R&S	ECSI	12/03/05	13/03/05	100364
<input type="checkbox"/>	LISN	R&S	ESH2-Z5	11/09/30	12/09/30	8287391006
<input type="checkbox"/>	CVCF	NF Electronic	4420	11/03/08	12/03/08	304935/337980
<input type="checkbox"/>	RFI/FIELD Intensity Meter	ES4152	424059	11/09/30	12/09/30	424059
<input type="checkbox"/>	Wideband Radio Communication Tester	R&S	CMW500	11/09/30	12/09/30	100989